

NOTE

This manual documents the Model 2205A and its assemblies at the revision levels shown in Section 8. If your instrument contains assemblies with different revision letters, it will be necessary for you to either update or backdate this manual. Refer to the supplemental change/errata sheet for newer assemblies or to the backdating sheet in Section 8 for older assemblies.

2205A

Switch Controller

Instruction Manual

P/N 633644
JANUARY 1982

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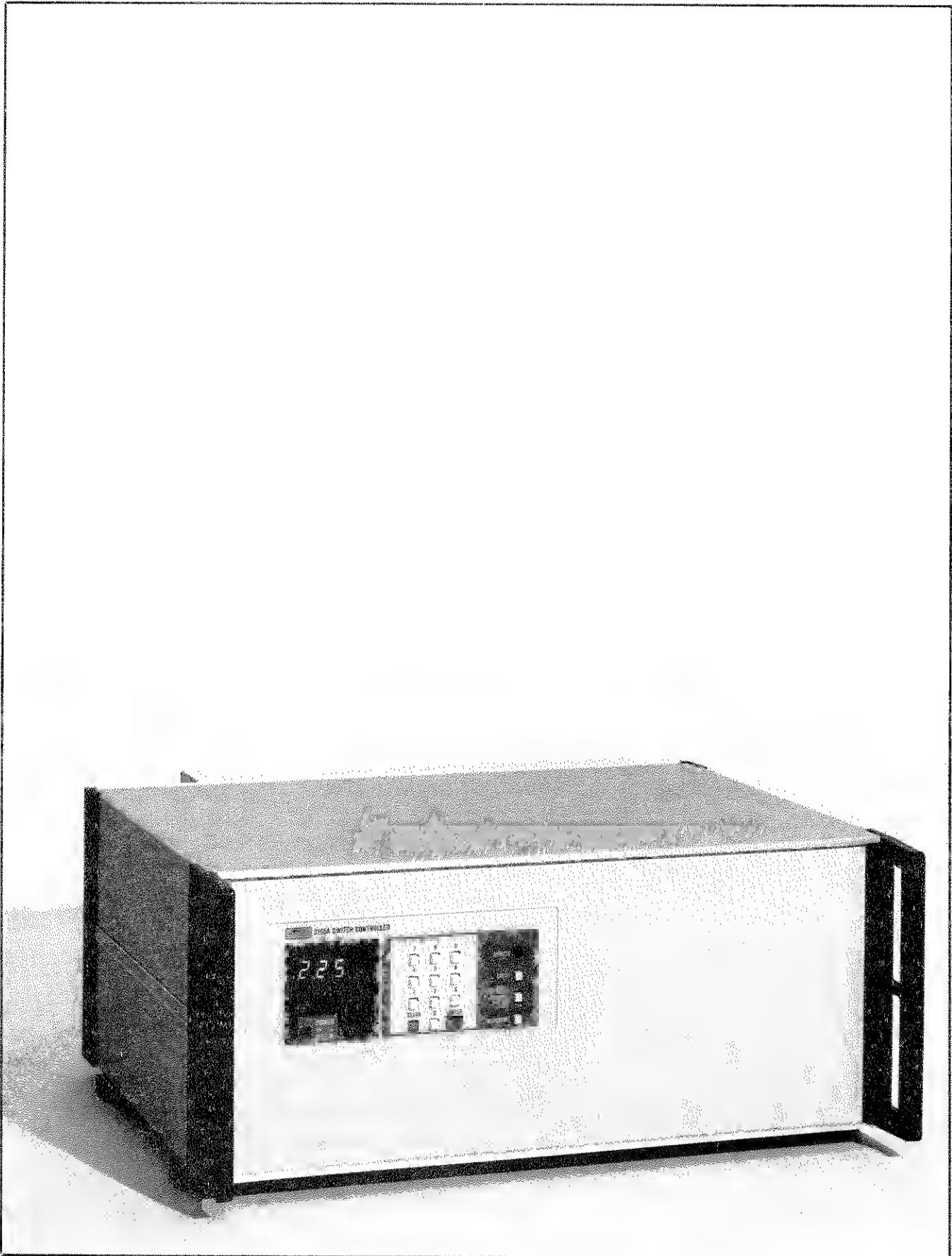
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2205A Switch Controller

Section 1

Introduction and Specifications

1-1. INTRODUCTION

1-2. The Fluke Model 2205A Switch Controller is an instrument mainframe which accepts plug-in options for multi-function switching of analog signals. The 2205A is designed for automatic test equipment (ATE) and data acquisition system use. The switch modules functionally accommodate the three fundamental requirements for switching in instrumentation systems: signal acquisition, distribution, and control.

1-3. The key feature of the 2205A is its modular configuration which supports concurrent multi-function switching. Other important features include: low thermal design for low level measurement applications, dual guarded internal scanner bus for precision resistance measurements or parallel scanning, and expansion capability. In its basic form, the 2205A is capable of physically housing up to 10 switch modules and can be expanded to electrically control up to 100 switch modules. The 2205A is also compatible with companion instruments for system application.

1-4. The front panel of the 2205A features the controls and indicators necessary for manual (local) control of the switch modules. Commands are entered on a calculator-type keyboard (0-9) and are displayed on a three-digit LED display. Three control buttons (BLOCK RESET/T.C. REF. JUNCTION, LOCAL, and INCREMENT) are provided for commanding thermocouple reference junction measurements or module resets (depending on type of module addressed), local recall (remote-to-local), and channel increment.

1-5. The rear panel of the 2205A includes a remote interface connector (for use on IEEE-488 or RS-232-C Standard buses), an extender connector to add extension mainframes, an analog connector for connecting the internal scanner buses to an external instrument such as a digital multimeter (DMM), and a trigger output connector for initiating a DMM reading. An analog output cable for connection between the 2205A and a system type DMM is supplied with the 2205A. The remote interface cable, the trigger output cable (coax with BNC connectors), and an extender cable (which is required when adding an extension chassis) are options and are not included with the unit. Extender cables are available as accessories and are fabricated by the factory to meet particular cable length requirements. Cable lengths from 3 to 1500 feet may be used depending upon the extension mainframe employed.

1-6. The slots for the switch modules are also located at the rear of the 2205A. They consist of a series of 10 pcb slots (blocks) numbered from 0 through 9. Each slot will accommodate a plug-in relay pcb and an input connector for supplying analog data to the 2205A. The relay pcbs and the input connectors make-up a module are available as options.

1-7. All options and accessories available for use with the 2205A are listed in Table 1-1. Details necessary for specification, installation, operation, and maintenance are given in Section 7 of this manual.

1-8. SPECIFICATIONS

1-9. The specifications for the Model 2205A Switch Controller are listed in Table 1-2.

Table 1-1. Options and Accessories

| OPTION/ MODEL NO. | DESCRIPTION | OPTION/ MODEL NO. | DESCRIPTION |
|----------------------|------------------------------------|----------------------|--|
| 2201A | Extender Scanner Chassis and Cable | 2205A-300 | General Purpose Scanner Module |
| 2202A | Remote Scanner Chassis and Cable | 2205A-400 | Four-wire Resistance Scanner Module (requires 2 slots) |
| 2200A-7001 | Remote Scanner Connector Kit | 2205A-600 | Low Level Scanner Module |
| 2200A-7002 | Remote Scanner Cable | M07-205-600 | Rack Mounting Kit |
| 2205A-050 | IEEE-488 Compatible Interface | M00-280-610 | Rack Slide Kit |
| 2205A-060 | RS-232-C Interface | Y8001 | 1 Meter IEEE-488 Compatible I/F Cable |
| 2205A-100 | Actuator Module | Y8004 | 3 Meter RS-232 I/F Cable |
| 2205A-200 | Latching Module | Y8013 | Delay Trigger Cable |
| | | Y8078 | Analog Signal Cable |

Table 1-2. 2205A Specifications

| | |
|-------------------------------------|---|
| ELECTRICAL CHANNEL CAPACITY | |
| Mainframe | Any combination of ten switch modules. Up to 100 channels of scanning capacity, 80 latching relays, 50 actuator relays, or 50 channels of four wire switching. |
| System | Up to nine extender chassis can be serially added to the 2205A for a maximum of 100 switch modules. This provides up to 1000 channels of scanning, 800 latching channels, or 500 actuator relays. A system with one 2205A and no 2202A is power limited to 100 latching closures, or 50 actuator closures, or any equivalent combination at any one time. |
| CHANNEL SWITCHING RATE | Switch selectable equal to on-delay plus off-delay plus logic-delay. |
| On Delay | 2 ms or 4 ms |
| Off Delay | 2, 4, 6 or 8 ms |
| Logic Delay | 2 ms maximum |
| | Use 2 + 4 ms for general purpose scanning modules. Use 4 + 8 ms for low level scanning modules. |
| TRIGGER OUTPUT | A negative going TTL compatible pulse of 15 μ s, referenced to logic common. |
| SCANNER BUS SPECIFICATIONS | |
| Isolation | Signal lines to power ground, $>10^{10} \Omega$. |
| Cross Talk | Less than 30 dB below applied signal from dc to 1 MHz when terminated with 1 M Ω . |
| Noise | General purpose and low level scanning modules only. |

Table 1-2. 2205A Specifications (cont)

| | | | |
|-------------------------------------|---|--------|--------------------|
| COMMON MODE REJECTION | | | |
| (50 to 60 Hz) | -90 dB for 1 k Ω unbalanced. See extender chassis manuals for specifications of CMR with added external chassis. | | |
| BROADBAND | Less than 1 μ V rms for a source resistance < 2 k Ω and a dc to 3 kHz bandwidth. | | |
| THERMAL | Low level modules; less than 1 μ V offset. General purpose modules; less than 10 μ V offset. | | |
| Leakage Resistance | High-to-low; $> 10^{10}\Omega$. | | |
| Channel Capacitance | 2205A with two like scanner modules on the internal scanner bus. | | |
| | OPEN | CLOSED | EACH ADDED SCANNER |
| LOW LEVEL, HI TO LO | 4 pF | 30 pF | 2 pF |
| GENERAL PURPOSE, HI TO LO | 8 pF | 70 pF | 8 pF |
| INTERCHANNEL | 3 pF | 5 pF | |
| Common Mode Voltage | Guard to chassis; 170V dc or peak ac (50 to 60 Hz) maximum. Logic common to chassis; 30V dc or peak ac maximum. | | |
| ENVIRONMENTAL SPECIFICATIONS | | | |
| Operating Temperature | 0 to +50°C | | |
| Storage Temperature | -55 to +75°C | | |
| Relative Humidity | 0 to 80% up to +40°C | | |
| GENERAL SPECIFICATIONS | | | |
| Display | A 3-digit LED display is used to indicate the selected channel. Also provides remote interface identification when the unit is initially turned on. | | |
| Remote Interfaces | IEEE-488 or RS-232 Compatible Interfaces are available as options. | | |
| Power | Selectable 100, 120, 220, or 240V $\pm 10\%$, 50 to 60 Hz, 15 VA maximum. | | |
| Dimensions | 17.8 cm H x 43.2 cm W x 44.2 cm D 7 in H x 17 in W x 17.4 in D (See Figure 1-1) | | |
| Weight | 7.1 kg (15.6 lbs) without options. | | |

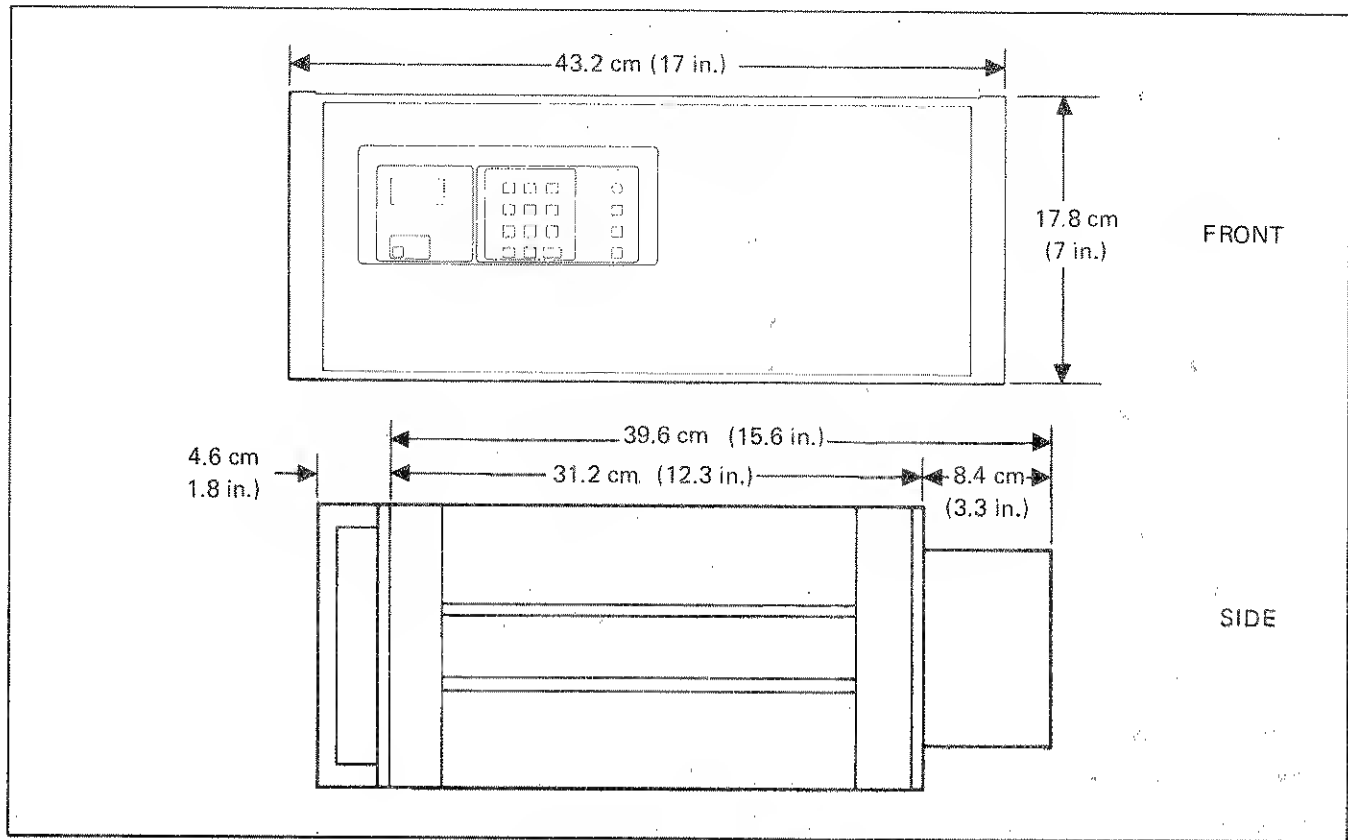


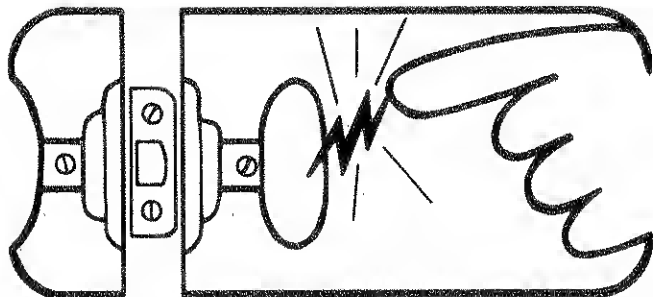
Figure 1-1. Outline Drawing



static awareness



A Message From
John Fluke Mfg. Co., Inc.



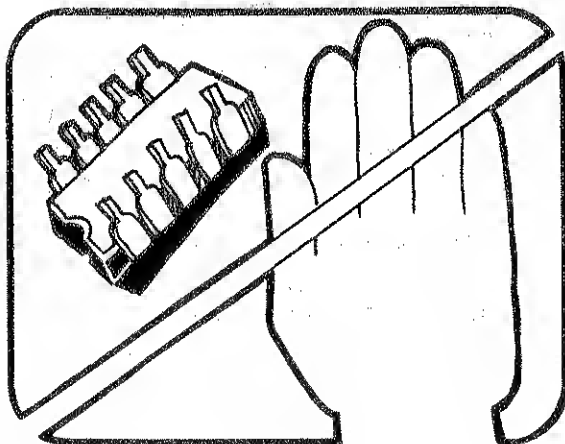
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

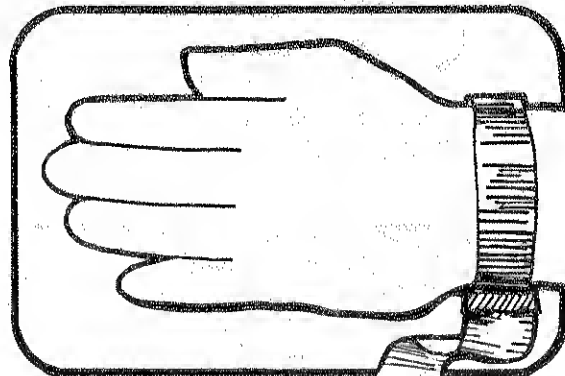
The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol



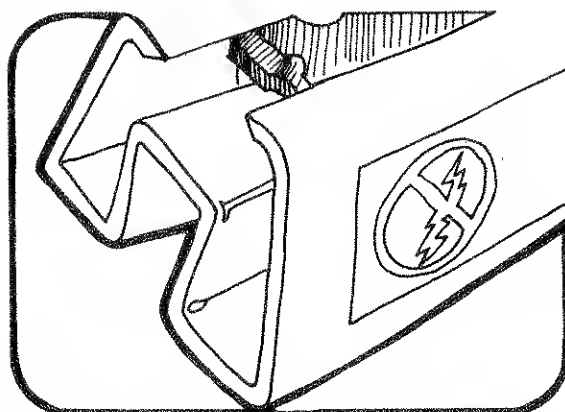
The following practices should be followed to minimize damage to S.S. devices.



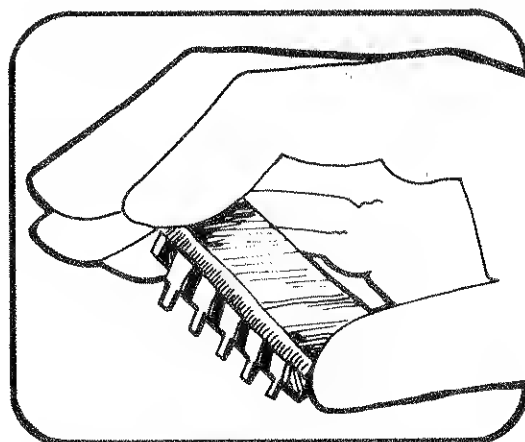
1. MINIMIZE HANDLING



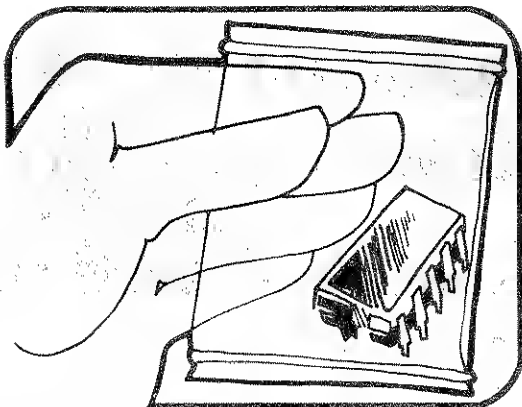
3. DISCHARGE PERSONAL STATIC
BEFORE HANDLING DEVICES



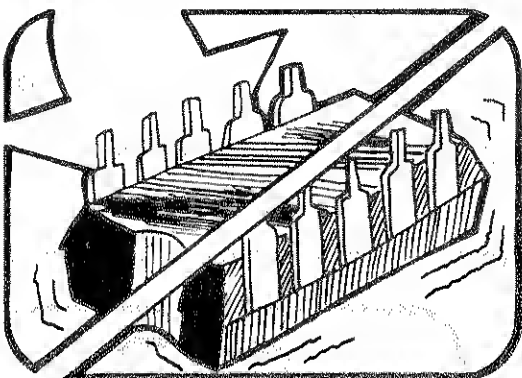
2. KEEP PARTS IN ORIGINAL CONTAINERS
UNTIL READY FOR USE.



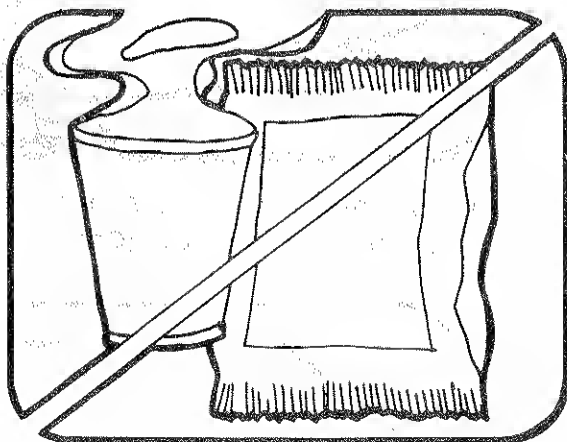
4. HANDLE S.S. DEVICES BY THE BODY



5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT

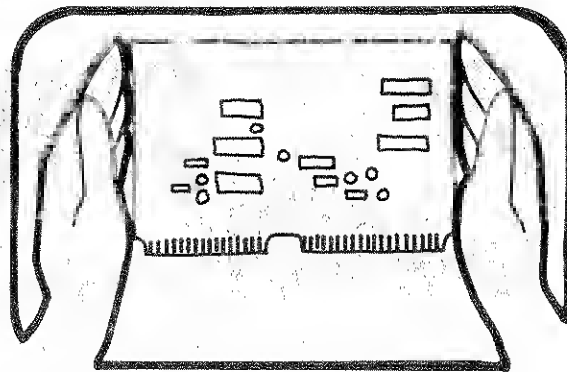


6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE

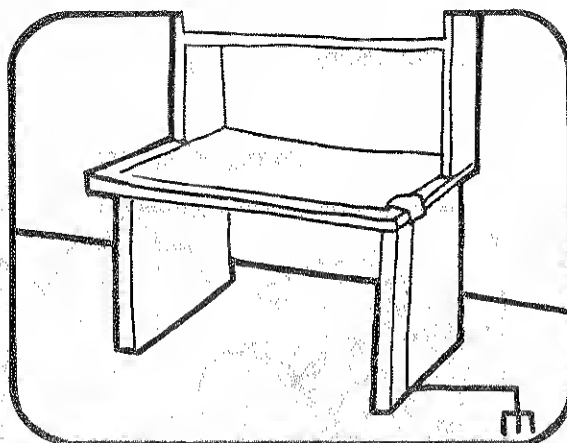


7. AVOID PLASTIC, VINYL AND STYROFOAM® IN WORK AREA

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AND GENERAL DYNAMICS, POMONA DIV.



8. WHEN REMOVING PLUG-IN ASSEMBLIES, HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR USUALLY PROVIDES COMPLETE PROTECTION TO INSTALLED SS DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION
10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.
11. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

| John Fluke Part No. | Description |
|---------------------|---------------|
| 453522 | 6" X 6" Bag |
| 453530 | 8" X 12" Bag |
| 453548 | 16" X 24" Bag |
| 454025 | 12" X 15" Bag |
| Pink Poly Sheet | Wrist Strap |
| 30"x60"x60 Mil | P/N TL6-60 |
| P/N RC-AS-1200 | \$7.00 |
| \$20.00 | |

Section 2 Installation

WARNING

THESE INSTALLATION INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY PROCEDURES OTHER THAN THOSE CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

2-1. INTRODUCTION

2-2. This section provides the information for the installation and set-up of the 2205A Switch Controller. The following also covers operating features that should be taken into consideration before operating the 2205A.

2-3. SHIPPING INFORMATION

2-4. The 2205A is packaged and shipped in a foam-packed container. Upon receipt of the instrument, a thorough inspection should be made to reveal any possible shipping damage. Special instructions for inspection and claims are included in the shipping carton.

2-5. If reshipment of the instrument is necessary, the original container should be used. If the original container is not available, a new container can be obtained from the John Fluke Mfg. Co., Inc. Please reference the instrument's model number when requesting a new shipping container.

2-6. INPUT POWER

2-7. The 2205A can be configured to operate from any one of the following voltages: 100, 120, 220, or 240V ac $\pm 10\%$, 50 to 60 Hz. A rear panel decal identifies the line voltage selected prior to shipment. Figure 2-1 gives the complete procedure for changing to one of the other voltage configurations if a different one is required.

2-8. The three-prong, line-power connector (on the rear panel) permits the 2205A to be connected through the power cord to the local line power. The offset prong on this connector is connected to the 2205A chassis and

should be connected, via the power cord, to a high quality earth ground.

2-9. FUSE REPLACEMENT

2-10. The line fuse is safely accessible from the rear of the 2205A and can be easily replaced. Check and/or replace the fuse as follows:

1. Set the power switch to OFF and disconnect the power cord from line power.
2. Disconnect the power cord from the 2205A. The fuse compartment is located just below the power connector.
3. Open the fuse compartment by sliding the see-thru fuse cover toward the power connector.
4. Locate the fuse tab (next to fuse) and gently lift it up. This releases and lifts one end of the fuse.
5. Remove and inspect the fuse. If replacement is required, use MDL 1/4 amp fuse for 100/120V ac operations and MDL 1/8 amp fuse for 220/240V ac operation.
6. Lower the fuse tab and press a good fuse into the fuse holder.
7. Close the fuse compartment and connect the power cord.

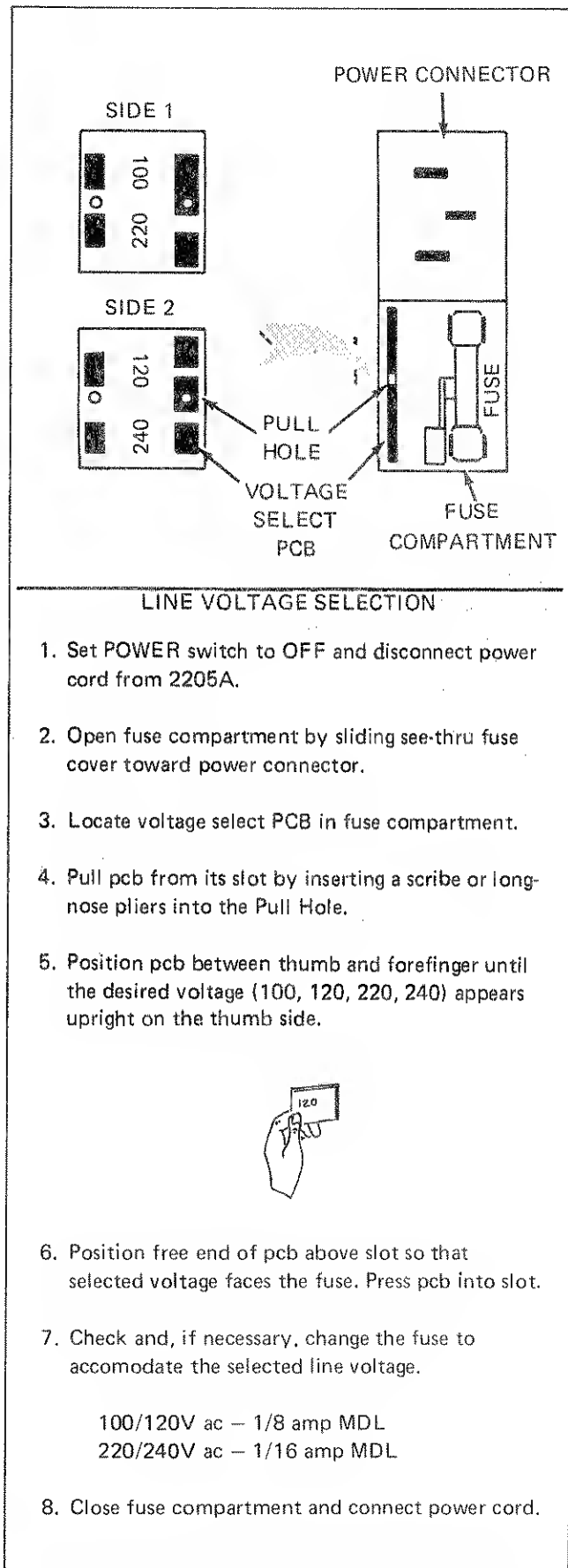


Figure 2-1. Line Voltage Selection Details

2-11. INSTALLATION NOTES**2-12. Introduction**

2-13. The following paragraphs describe various conditions which should be considered before installing the 2205A.

2-14. Switch Modules

2-15. The 2205A is designed to accommodate any combination of up to 10 of either type switch module. The scanning modules provide 10 channels of analog signals using a common output bus. That is, when any one of the 10 channels is selected, that channel (high, low, and guard) is connected to one of the 2205A internal scanner buses for measurement (or stimulus) purposes. The switching modules provide programmable switching of external stimulus or signal lines under the control of the 2205A. These modules provide relays of various ratings and configurations for latching, external scanning, matrices, and other isolated switching functions.

2-16. Due to the wide variety of functions, review the descriptions of each module in Section 7 to ensure compatibility between the module and the intended application. Descriptions include specifications and the necessary information for installation, operation, and maintenance of the module.

2-17. Analog Signal Cable

2-18. An Analog Signal Cable (Y8076) is provided with the 2205A. The cable connects the internal scanner buses to the terminals of a system type DMM. Jumpers are installed on the connector to tie the buses together for two-wire operation. If four-wire operation is preferred, the high and low jumpers should be removed from the 2205A end of the cable (Figure 2-2). These jumpers parallel the two analog buses and make them appear as a single bus.

2-19. Internal Scanner Buses

2-20. The 2205A is equipped with two internal analog buses (bus 1 and bus 2) for use in conjunction with the relay scanning modules. Bus 1 is associated with the even numbered slots (0, 2, 4, 6, 8,) and bus 2 is associated with the odd numbered slots (1, 3, 5, 7, 9,). Each bus consists of three lines; high, low, and guard. When a channel relay is selected on a given scanning module, that channel and its input signal are connected to the appropriate internal scanner bus.

2-21. Channel relays may be closed singly or in pairs. If closed singly, the analog buses should be connected in parallel at the Analog Signal Cable so that a single bus is formed. This configuration is called two-wire operation. That is, a single two-wire bus (high, low, guard) is common to all channels. If the relays are closed in pairs, the buses should remain electrically isolated so that two separate buses (bus 1 and bus 2) are available at the Analog Cable Output connector. This configuration, is

called four-wire operation. That is, a four-wire bus (high 1, high 2, low 1, low 2, guard, and shield 2) is common to all channel pairs. Guard and shield 2 are generally connected together at the Analog Signal Cable to form a single instrument guard. The desired bus operation is manually selected, and applies to all channels in the 2205A.

2-22. In the four-wire operation, relay pairs are closed by selecting a channel in one of the even numbered slots (0, 2, 4, 6, 8). The selected channel relay in the even numbered slot plus the corresponding channel relay in the next higher odd numbered slot are closed together. Thus, slots 0 and 1, 2 and 3, 4 and 5, 6 and 7, 8 and 9 operate as pairs. Selecting a channel in an odd numbered slot closes only that channel, not the pair.

NOTE

Four-wire operation is possible only in the 2205A. Extender chassis are configured for two-wire operation.

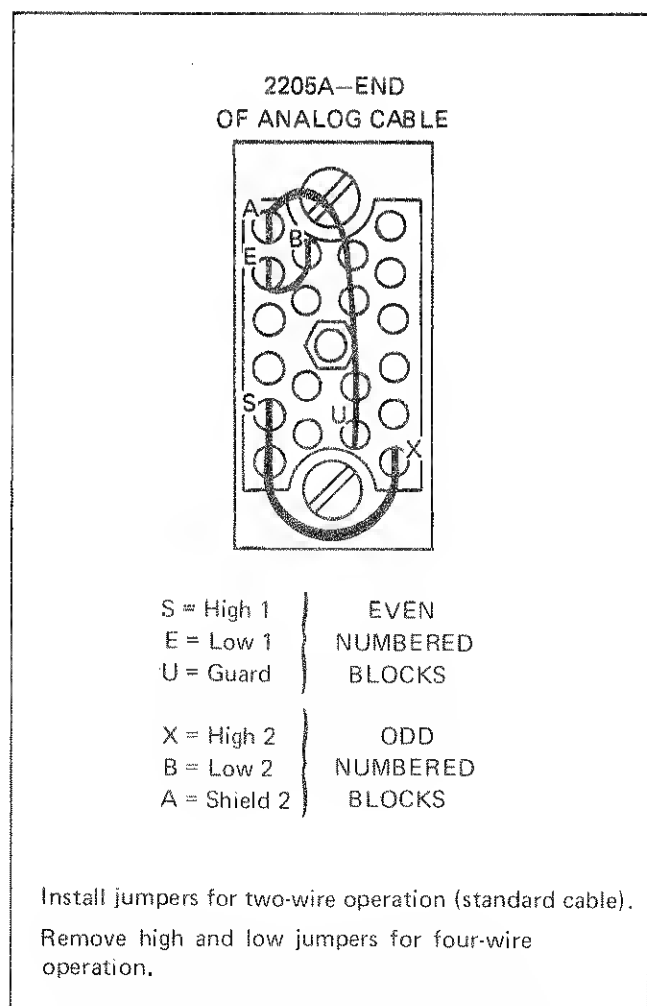


Figure 2-2. Analog Signal Cable Jumpers

2-23. INTERNAL SWITCHES

2-24. Access Procedure

2-25. All internal switches can be accessed by removing the top cover from the 2205A. The locations of the applicable switches are shown in Figure 2-3. Switch setting procedures are given later in this section of the manual. Complete the following procedure to remove the top cover:

WARNING

TO AVOID ELECTRICAL SHOCK HAZARD REMOVE LINE POWER AND THE MODULE INPUT CONNECTORS FROM THE 2205A BEFORE REMOVING THE TOP COVER. LETHAL VOLTAGES MAY BE PRESENT AT THE LINE POWER INPUT CONNECTOR AND THE POWER SUPPLY PCB ASSEMBLY WHEN THE 2205A IS CONNECTED TO LINE POWER. LETHAL COMMON MODE VOLTAGES MAY ALSO BE PRESENT AT THE MODULE INPUT CONNECTORS, EXTENDER CHASSIS AND MODULE PCBs EVEN THOUGH THE LINE POWER CORD IS DISCONNECTED.

1. Disconnect the controller mainframe from line power.
2. Disconnect and remove all of the switch module input connectors.
3. Remove the six screws on the top of the unit.
4. Remove the top cover.
5. Reverse the procedure to re-install the top cover.

2-26. Two-/Four-wire Bus Selection

2-27. The internal slide switch S1 on the Extended Bus PCB Assembly allows selection of either a two-wire or a four-wire bus operation of the internal scanner bus. The procedure for accessing and setting the switch follows:

1. Use the Access Procedure to remove the 2205A top cover and locate the two-/four-wire switch (S1) on the Extended Bus PCB (Figure 2-3).
2. Set the switch to the desired bus operation; toward the rear of the unit for four-wire, forward for two-wire.
3. Use the Access Procedure to install the top cover.

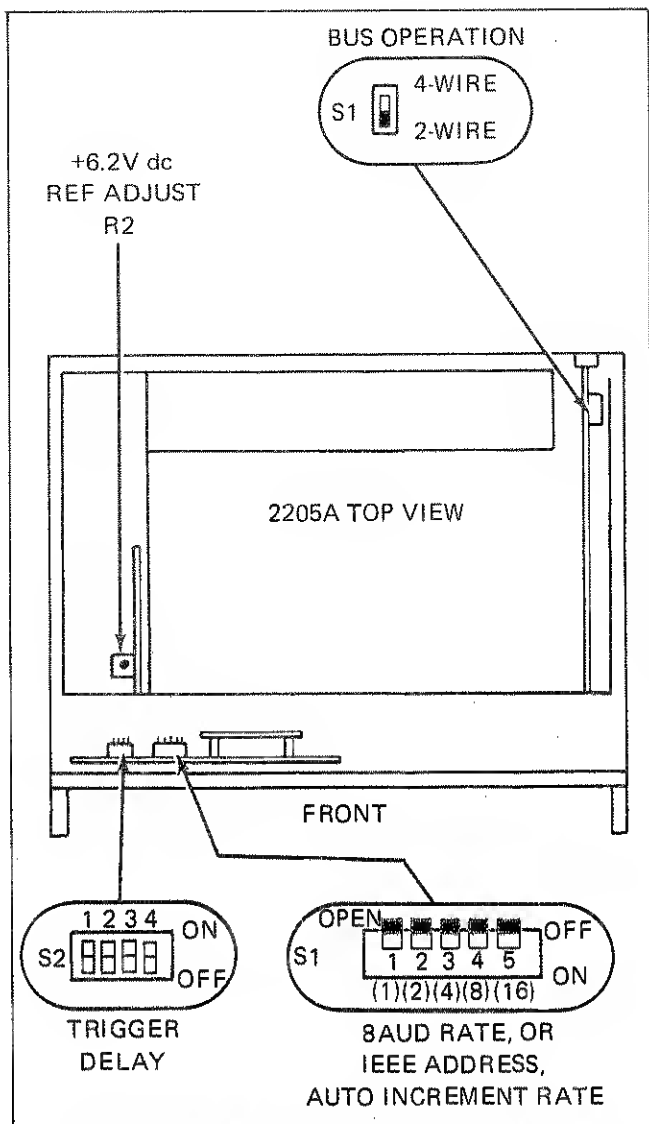


Figure 2-3. Internal Switch and Adjustments Location

Table 2-1. Auto Scan Rate Selection

| RATE IN SEC/CHANNEL | SWITCH S1 | | | | |
|------------------------|-----------|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 0.2 | 0 | 0 | 0 | 0 | 0 |
| 0.3 | 1 | 0 | 0 | 0 | 0 |
| 0.4 | 0 | 1 | 0 | 0 | 0 |
| 0.5 | 1 | 1 | 0 | 0 | 0 |
| 0.6 | 0 | 0 | 1 | 0 | 0 |
| 0.7 | 1 | 0 | 1 | 0 | 0 |
| 0.8 | 0 | 1 | 1 | 0 | 0 |
| 0.9 | 1 | 1 | 1 | 0 | 0 |
| 1.0 | 0 | 0 | 0 | 1 | 0 |
| 1.1 | 1 | 0 | 0 | 1 | 0 |
| 1.2 | 0 | 1 | 0 | 1 | 0 |
| 1.3 | 1 | 1 | 0 | 1 | 0 |
| 1.4 | 0 | 0 | 1 | 1 | 0 |
| 1.5 | 1 | 0 | 1 | 1 | 0 |
| 1.6 | 0 | 1 | 1 | 1 | 0 |
| 1.7 | 1 | 1 | 1 | 1 | 0 |
| 1.8 | 0 | 0 | 0 | 0 | 1 |
| 1.9 | 1 | 0 | 0 | 0 | 1 |
| 2.0 | 0 | 1 | 0 | 0 | 1 |
| 2.1 | 1 | 1 | 0 | 0 | 1 |
| 2.2 | 0 | 0 | 1 | 0 | 1 |
| 2.3 | 1 | 0 | 1 | 0 | 1 |
| 2.4 | 0 | 1 | 1 | 0 | 1 |
| 2.5 | 1 | 1 | 1 | 0 | 1 |
| 2.6 | 0 | 0 | 0 | 1 | 1 |
| 2.7 | 1 | 0 | 0 | 1 | 1 |
| 2.8 | 0 | 1 | 0 | 1 | 1 |
| 2.9 | 1 | 1 | 0 | 1 | 1 |
| 3.0 | 0 | 0 | 1 | 1 | 1 |
| 3.1 | 1 | 0 | 1 | 1 | 1 |
| 3.2 | 0 | 1 | 1 | 1 | 1 |
| 3.3* | 1 | 1 | 1 | 1 | 1 |

* = Err displayed on turn on
1 = OFF (OPEN) 0 = ON (CLOSED)

2-28. Auto Increment Rate Selection

2-29. The auto increment rate for the 2205A is selectable using the five-lever switch S1 located on the back of the Front Panel Display PCB. Normally, during remote operation switch S1 defines the baud rate or IEEE address of the remote interface. However, when the auto increment mode is enabled S1 defines the auto increment rate. The procedure for accessing and setting the auto increment switches follows:

1. Use the Access Procedure to remove the 2205A top cover and locate S1 on the Front Panel Display PCB (Figure 2-3).
2. Refer to the list of increment rate codes in Table 2-1 and set the S1 switch levers to match the desired rate.
3. Use the Access Procedure to install the top cover.

2-30. Trigger Output**CAUTION**

The low side of the TRIGGER OUTPUT connector is connected to Logic Common, not chassis ground. Do not connect the low side of the connector to a potential more than 30V above chassis ground.

2-31. A trigger pulse is available from the rear panel of the 2205A at the BNC connector marked TRIGGER OUTPUT. The function of the trigger pulse is to serve as a measurement command to externally trigger a system type DMM. The trigger pulse is TTL compatible and occurs as a 15 microsecond negative-going pulse (+5V dc to Logic Common). The elapsed time between channel

selection and the Trigger Output pulse can be selected to ensure that the channel relays operate in a break-before-make pattern. Eight patterns are available. Two of these are recommended for use with particular types of switch modules. The possible delay patterns are defined in Figure 2-4. The times listed are fixed and are cumulative. When a channel is selected the affected relays operate in a break-before-make pattern and settle within the allotted time period.

2-32. The elapsed time between a channel selection and the trigger output pulse can be manually selected by switch S2 on the Front Panel Display PCB. The procedure for accessing and setting this switch is as follows:

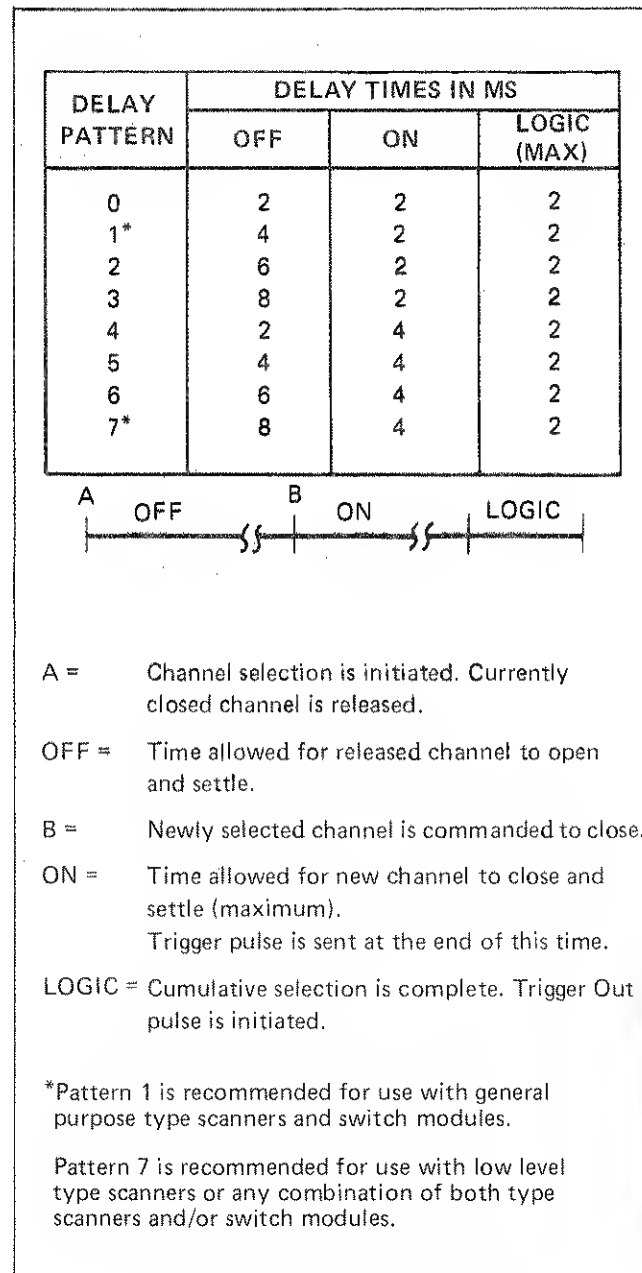


Figure 2-4. Trigger Delay Patterns

1. Use the Access Procedure to remove the 2205A top cover and locate switch S2 on the Front Panel Display PCB (Figure 2-3).

2. Refer to the list of delay patterns given in Table 2-2. Set S2 to match the desired delay. Pattern 7 is recommended for use with the Low Level Scanner Module (Option -600), and pattern 1 is recommended for use with the General Purpose Scanner Module (Option -300). If a combination of both scanning modules is used, pattern 7 is recommended.

3. Use the Access Procedure to install the top cover.

Table 2-2. Trigger Delay Selection

| DELAY PATTERN | SWITCH S2* | | | | DELAY IN ms | | |
|---------------|------------|---|---|---|-------------|----|-------|
| | 1 | 2 | 3 | 4 | OFF | ON | LOGIC |
| 0 | 0 | 0 | 0 | x | 2 | 2 | 2 |
| 1 | 1 | 0 | 0 | x | 4 | 2 | 2 |
| 2 | 0 | 1 | 0 | x | 6 | 2 | 2 |
| 3 | 1 | 1 | 0 | x | 8 | 2 | 2 |
| 4 | 0 | 0 | 1 | x | 2 | 4 | 2 |
| 5 | 1 | 0 | 1 | x | 4 | 4 | 2 |
| 8 | 0 | 1 | 1 | x | 8 | 4 | 2 |
| 7 | 1 | 1 | 1 | x | 8 | 4 | 2 |

*0 = ON
1 = OFF
x = DON'T CARE

2-33. Baud Rate Selection

2-34. Baud rates for the RS-232-C Interface are selectable using the five-lever switch S1 located on the back of the Front Panel Display PCB. The procedure for accessing and setting this switch is as follows:

1. Use the Access Procedure to remove the 2205A top cover and locate switch S1 on the Front Panel Display PCB (Figure 2-3).

2. Refer to the baud rate codes in Table 2-3. Set the S1 switch levers to the code that corresponds to the desired baud rate.

3. Use the Access Procedure to install the top cover and energize the unit. The display should read 'b' followed by the assigned baud rate code (0-7).

Table 2-3. Baud Rate Selection

| BAUD RATE | SWITCH S1 | | | | | DISPLAY CODE |
|-----------|-----------|---|---|---|---|--------------|
| | 1 | 2 | 3 | 4 | 5 | |
| 110 | 0 | 0 | 0 | x | x | b-0 |
| 134.5 | 1 | 0 | 0 | x | x | b-1 |
| 150 | 0 | 1 | 0 | x | x | b-2 |
| 300 | 1 | 1 | 0 | x | x | b-3 |
| 600 | 0 | 0 | 1 | x | x | b-4 |
| 1200 | 1 | 0 | 1 | x | x | b-5 |
| 2400 | 0 | 1 | 1 | x | x | b-6 |
| 4800 | 1 | 1 | 1 | x | x | b-7 |

1 = OFF (OPEN)
0 = ON (CLOSED)
x = DON'T CARE

During normal TTY operation, all baud rates are useable. If a controller is used at a baud rate of 1200, 2400 or 4800; commands may be missed if consecutive channel selections are made at a rate that is faster than the relays can switch. See Figure 2-4, for relay switching times.

accomplished through the use of one or more of the Models 2201A or 2202A Extender Chassis. Figure 2-5 shows the interconnection of extenders in a typical 2205A system. Each extension chassis is capable of housing and controlling either 10 (2202A) or 12 (2201A) modules. The chassis interconnect in a daisy-chain fashion, and the first unit in the chain connects to the EXTENDER CABLE I/O connector on the rear of the 2205A. These chassis are available as accessories (see Section 7). The 2201A and 2202A chassis are documented in separate stand-alone manuals.

Table 2-4. IEEE Address Selection

| IEEE ADDRESS | SWITCH S1 | | | | | DISPLAY CODE |
|--------------|-----------|---|---|---|---|--------------|
| | 1 | 2 | 4 | 3 | 5 | |
| 0 | 0 | 0 | 0 | 0 | 0 | A-0 |
| 1 | 1 | 0 | 0 | 0 | 0 | A-1 |
| 2 | 0 | 1 | 0 | 0 | 0 | A-2 |
| 3 | 1 | 1 | 0 | 0 | 0 | A-3 |
| 4 | 0 | 0 | 1 | 0 | 0 | A-4 |
| 5 | 1 | 0 | 1 | 0 | 0 | A-5 |
| 6 | 0 | 1 | 1 | 0 | 0 | A-6 |
| 7 | 1 | 1 | 1 | 0 | 0 | A-7 |
| 8 | 0 | 0 | 0 | 1 | 0 | A-8 |
| 9 | 1 | 0 | 0 | 1 | 0 | A-9 |
| 10 | 0 | 1 | 0 | 1 | 0 | A10 |
| 11 | 1 | 1 | 0 | 1 | 0 | A11 |
| 12 | 0 | 0 | 1 | 1 | 0 | A12 |
| 13 | 1 | 0 | 1 | 1 | 0 | A13 |
| 14 | 0 | 1 | 1 | 1 | 0 | A14 |
| 15 | 1 | 1 | 1 | 1 | 0 | A15 |
| 16 | 0 | 0 | 0 | 0 | 1 | A16 |
| 17 | 1 | 0 | 0 | 0 | 1 | A17 |
| 18 | 0 | 1 | 0 | 0 | 1 | A18 |
| 19 | 1 | 1 | 0 | 0 | 1 | A19 |
| 20 | 0 | 0 | 1 | 0 | 1 | A20 |
| 21 | 1 | 0 | 1 | 0 | 1 | A21 |
| 22 | 0 | 1 | 1 | 0 | 1 | A22 |
| 23 | 1 | 1 | 1 | 0 | 1 | A23 |
| 24 | 0 | 0 | 0 | 1 | 1 | A24 |
| 25 | 1 | 0 | 0 | 1 | 1 | A25 |
| 26 | 0 | 1 | 0 | 1 | 1 | A26 |
| 27 | 1 | 1 | 0 | 1 | 1 | A27 |
| 28 | 0 | 0 | 1 | 1 | 1 | A28 |
| 29 | 1 | 0 | 1 | 1 | 1 | A29 |
| 30 | 0 | 1 | 1 | 1 | 1 | A30 |
| 31 * | 1 | 1 | 1 | 1 | 1 | Err |

* = Illegal address, Err = error

0 = ON (CLOSED)
1 = OFF (OPEN)
x = DON'T CARE

2-35. IEEE Address Selection

2-36. The listen address for the IEEE-488 Compatible Interface is selectable using the five-lever switch S1 located on the back of the Front Panel Display PCB. The procedure for accessing and setting this switch is as follows:

1. Use the Access Procedure to remove the 2205A top cover and locate switch S1 on the Front Panel Display PCB (Figure 2-3).
2. Refer to the list of address codes in Table 2-4. Set the S1 switch levers to match the desired IEEE address.
3. Use the Access Procedure to install the top cover and energize the unit. The display should read 'A' followed by the assigned address code (0-30).

2-37. RACK INSTALLATION

2-38. The 2205A is designed for either bench-top use or for installation in a standard 19-inch equipment rack. If rack mounting is desired, two rack mounting kits are available; a standard Rack Mount Kit (Model no. M07-205-600) and a Rack Slide Kit (Model no. M00-208-610). Installation instructions for both models are given in Section 7, Option and Accessory Information.

2-39. SCANNER EXTENSION

2-40. The capacity of the 2205A can be extended from 100 channels up to 1000 channels. The extension is

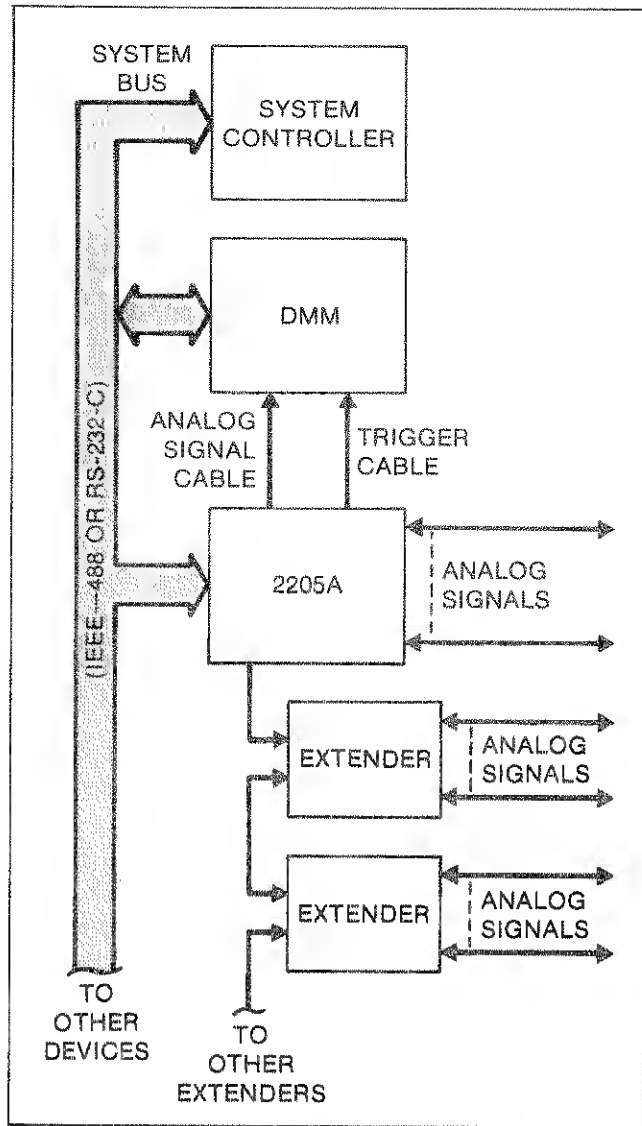


Figure 2-5. Typical 2205A System Interconnects

Section 3

Operating Instructions

3-1. INTRODUCTION

3-2. This section of the manual contains information concerning the operation of the Model 2205A Switch Controller. It is recommended that the contents of this section be read and understood before any attempt is made to operate the instrument. Should any difficulties arise during operation, contact your nearest John Fluke Sales Representative, or the John Fluke Mfg. Co., Inc., P.O.Box C9090, Everett, Washington, 98206. A list of sales representatives is given in the rear of this manual.

3-3. OPERATING FEATURES

3-4. All controls, indicators, and connectors for the 2205A are described in Figure 3-1.

3-5. OPERATING NOTES

3-6. Introduction

3-7. The following paragraphs describe various conditions which should be considered before operating the 2205A. This section assumes that the 2205A has been equipped with the desired switch modules and any other desired option or accessory. It also assumes that the unit has been incorporated into its normal operating environment and is connected to line power.

3-8. Internal Scanner Buses

3-9. The 2205A is equipped with two internal analog buses (bus 1 and bus 2) for use in conjunction with the relay scanning modules. Bus 1 is associated with the even numbered slots (0, 2, 4, 6, 8) and bus 2 is associated with the odd numbered slots (1, 3, 5, 7, 9). Each bus consists of three lines; high, low, and guard. When a channel relay is selected on a given scanning module, that channel and its input signal are connected to the appropriate internal scanner bus.

3-10. Channel relays may be closed singly or in pairs. If closed singly, the analog buses should be connected in parallel at the Analog Signal Cable so that a single bus is

formed. This configuration is called two-wire operation. That is, a single two-wire bus (high, low, guard) is common to all channels. If the relays are closed in pairs, the buses should remain electrically isolated so that two separate buses (bus 1 and bus 2) are available at the Analog Cable Output connector. This configuration is called four-wire operation. That is, a four-wire bus (high 1, high 2, low 1, low 2, guard, and shield 2) is common to all channel pairs. Guard and shield 2 are generally connected together at the Analog Signal Cable to form a single instrument guard. The desired bus operation is manually selected by an internal switch, and applies to channels in the 2205A only.

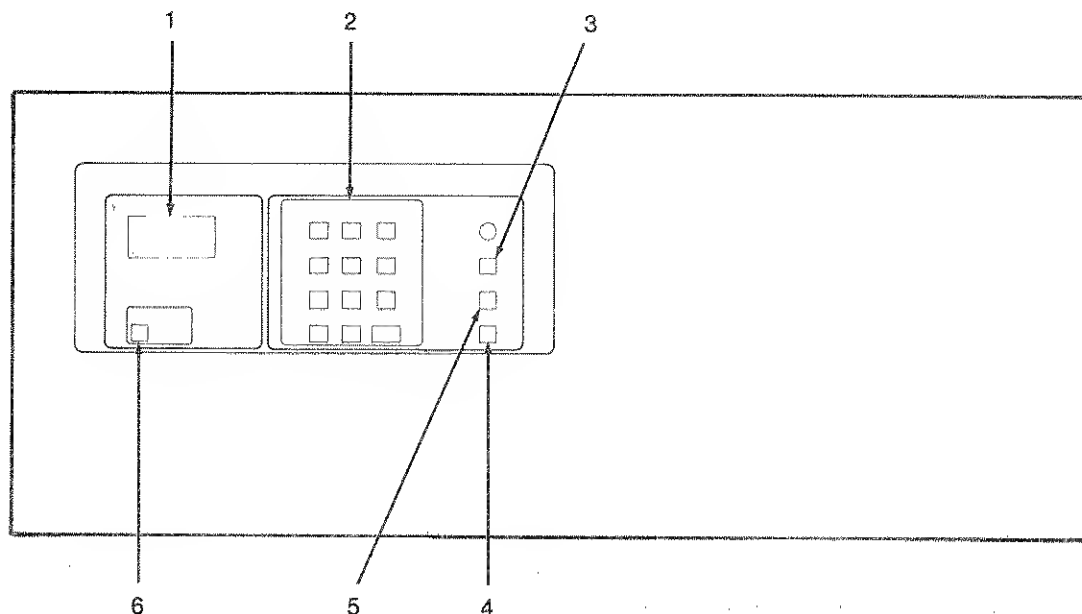
3-11. In the four-wire operation, relay pairs are closed by selecting a channel in one of the even numbered slots (0, 2, 4, 6, 8). The selected channel relay in the even numbered slot plus the corresponding channel relay in the next higher odd numbered slot are closed together. Thus, slots 0 and 1, 2 and 3, 4 and 5, 6 and 7, 8 and 9 operate as pairs. Selecting a channel in an odd numbered slot closes only that channel relay, not the pair.

NOTE

Four-wire operation is possible only in the 2205A. Extender chassis are configured for two-wire operation.

3-12. Local Operation

3-13. The scanning and switching functions of the 2205A can be manually controlled using the front panel switches. Table 3-1 lists the functions that can be performed and their respective control sequences. When a sequence is properly entered, the selected channel appears on the display. Other indications that can appear are defined in Table 3-2. Refer to the Operating Conditions information for important considerations before operating the unit.



| REF NO. | NAME | FUNCTION |
|---------|--|---|
| 1 | CHANNEL DISPLAY | Three seven-segment LEDs used to indicate the displayed or selected channel (000 through 999). Also indicates baud rate address for remote interface and data entry messages. |
| 2 | DATA Keyboard | Calculator type keyboard, with CLEAR and ENTER switches, used for manual entry of channel control data. |
| 3 | LOCAL Switch, REMOTE LED | A pushbutton switch used to recall local (manual) operating mode if unit is in remote. REMOTE LED is lit in the remote mode. |
| 4 | INCREMENT Switch | A pushbutton switch used to manually increment the displayed channel. |
| 5 | BLOCK RESET/T.C. REFERENCE JUNCTION Switch | A pushbutton switch to reset switch modules to their normal condition. Also used to manually select (for measurement the reference voltage of a displayed channel, 0 through 999. An r is displayed to indicate that a reference voltage is selected. |
| 6 | POWER Switch | A green pushbutton switch used to turn the instrument on and off. |

Figure 3-1. 2205A Controls, Indicators and Connectors

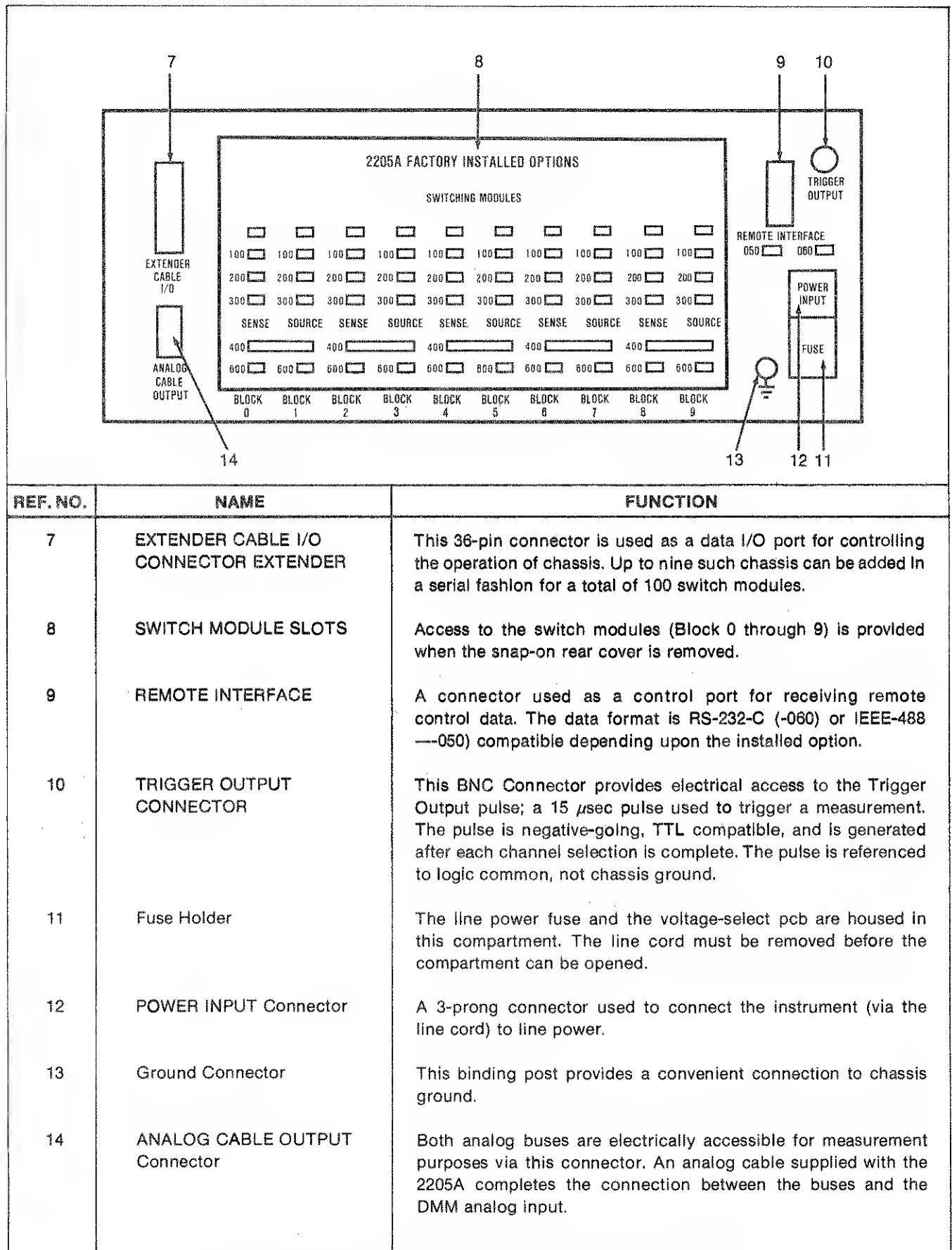


Figure 3-1. 2205A Controls, Indicators and Connectors (cont)

Table 3-1. Front Panel Control Functions

| FUNCTION | FRONT PANEL CONTROL SEQUENCE |
|--|--|
| Select a channel. | [DIGIT] [DIGIT] [DIGIT] [ENTER] |
| Clear the display. | [CLEAR] |
| Open all channels. | [CLEAR] [ENTER] |
| Reset boundaries to 0 and 99. | [CLEAR] [ENTER] [ENTER] |
| Set a lower scan boundary channel. | [DIGIT] [DIGIT] [DIGIT] [ENTER] [ENTER] 0 |
| Set an upper scan boundary channel. | [DIGIT] [DIGIT] [DIGIT] [ENTER] [ENTER] 1 |
| Select next higher channel. | [INCREMENT] |
| Initiate the auto increment mode. | [INCREMENT] and [LOCAL] Simultaneously |
| Exit the auto increment mode (last channel is still selected). | [CLEAR] |
| Exit the auto increment mode and clear all channels | [CLEAR] [ENTER] |
| Select isothermal block of displayed channel or reset displayed switch modules. | [BLOCK RESET/T.C. REF JUNCTION] |
| Go to local. Remote light will go out. | [LOCAL] |
| Clear error condition. | [CLEAR] |

Table 3-2. Channel Display Indications

| DISPLAY READING | DEFINITION |
|--------------------|---|
| ---- | All channels reset |
| — | Clear entry |
| Err | Function or control sequence is in error, try again. (Does not effect present status) |
| Axx | Address for IEEE Compatible Interface. (xx = 0 through 30) |
| b-x | Baud rate for RS-232-C Interface (x = 0 through 7) |
| xr | Block reset or temperature reference selected. (x = block 0-99) |

3-14. Auto Increment Operation

3-15. The auto increment mode is a free-run scanning condition that can be initiated (only in local operation) via the front panel controls. Upper and lower channel boundaries can be assigned so that the scanning cycle includes only the channels of interest. For example, if 3 and 5 are assigned as lower and upper boundaries respectively, the auto increment mode, when initiated, will continuously cycle from channel 3 through channel 5.

NOTE

The 2205A does not respond to any remote commands while scanning in auto increment mode.

3-16. The timing for the relay switching and the Trigger Output are given in the Installation section of this manual. The auto increment rates range from 0.2 to 3.3 seconds per channel in 0.1 second increments.

NOTE

The 2205A will generate an external rear trigger pulse each time a module command to close a relay occurs.

3-17. Remote Operation**3-18. INTRODUCTION**

3-19. In a systems configuration, the 2205A can be remotely programmed via the rear panel REMOTE INTERFACE connector. The 2205A automatically enters the remote mode when data is received from the system controller. Data format is determined by the type of interface option installed in the 2205A, the RS-232-C Interface (Option -060) or the IEEE-488-compatible Interface (Option -050). To positively identify the option installed in a given unit, watch the channel display when the 2205A is turned on. If the IEEE option is installed, the instrument displays 'A' followed by a numeric listen

address code (0 through 30). If the RS-232-C option is installed, a 'b' followed by a numeric baud rate code (0 through 7) is displayed. If the interface option must be changed, refer to Section 7 for the installation and interface instructions. Refer to the Programming Conditions information for important considerations before operating.

3-20. PROGRAMMING FORMAT

3-21. Command strings are used to control the 2205A. A command string is a sequence of ASCII characters sent over the IEEE-488 or RS-232C remote interface. The 2205A will respond only to those upper case characters which are within its control character vocabulary. All other characters are ignored. Table 3-3 lists the Remote Control Characters recognized by the 2205A. Remote Control Characters are enclosed within quotes in the test to facilitate character identification.

3-22. If the Increment character "+" and the Reference Junction character "R" are sent without a channel being selected, an error will be generated. The message (Err) will be displayed on the front panel, and the command will be ignored. Note that the 2205A cannot generate a remote error message because it is a listener only.

3-23. Do not use autoscan from the front panel while operating via a remote interface (IEEE-488 or RS-232C). When the 2205A is in autoscan mode, it effectively ignores remote devices by not completing handshakes.

3-24. GENERAL COMMANDS

3-25. The following remote control commands can be used by both the IEEE-488 and RS-232C remote interface options.

3-26. Enter - The Comma (,) Command

3-27. The "," is the remote equivalent to the front panel ENTER key. It is used as a delimiter to terminate each numerical entry.

3-28. Reset - The \$ and * Commands

3-29. The 2205A can be reset on three levels. The first level, sending a "\$", only clears the display. The second level, sending a "*" or "\$", clears the display and resets all of the modules to power up condition. The third level, sending a "*", or "\$,," clears the display, resets all of the modules, and sets the lower and upper scanning boundaries to 0 and 99.

3-30. MODULE COMMANDS

3-31. Every module installed in the 2205A or extender chassis has a unique block address/ Also, each type of module has a set of module commands associated with it. Depending upon the module, the command can correspond to a specific channel, a relay position in a specific channel, or a block or relays on one module.

3-32. The Module Command Format is "bbc". The "bb" represents the block address, which ranges from 00 to 99. (If no block address is entered, the default address is 00.) The "c" represents the module command, a number between 0 and 9.

Table 3-3. Remote Control Characters

| EQUIVALENT REMOTE CONTROL CHARACTER SEQUENCE (ASCII) | REMARKS | KEYBOARD CONTROL SEQUENCE |
|--|--|-----------------------------------|
| 0 through 9 | Numeric data | 0 through 9 |
| , | Select displayed channel | ENTER |
| + | Increment displayed channel by one | INCREMENT |
| \$ | Clear display | CLEAR |
| R | Select reference junction of the displayed channel, or reset displayed block | T.C. REF JUNCTION/ BLOCK RESET |
| * or \$, | Open all channels | CLEAR ENTER |
| B0 | Set lower boundary | ENTER ENTER 0 |
| B1 | Set upper boundary | ENTER ENTER 1 |
| *, or \$,, | Reset boundaries to 0 and 99 | CLEAR ENTER ENTER |
| L | Set local lockout (RS-232-C only) | NONE |
| L0 | Reset local lockout (RS-232-C only) | NONE |

3-33. To select a channel under remote control, enter the numerical value of the channel using the "bbc" format, then enter the Entry command ",". This is the same format used for front panel entry.

3-34. The Block Reset/Reference Junction Selection command, "R", operates in the same manner as the front panel BLOCK RESET/T.C. REFERENCE JUNCTION key. When using the Isothermal Block Connector, the reference junction voltage can be measured and used to calculate thermocouple temperatures. The "R" command connects the reference junction of the Block being addressed to the scanning bus. If "R" is sent to a block other than an Isothermal Block, it acts as a Block Reset. If no channel is addressed, (Err) appears on the front panel and the command is ignored.

3-35. 2205A-100 Actuator Module Commands

3-36. The -100 module has 5 SPDT relays with contacts identified as Common, Normally Open (N.O.), and Normally Closed (N.C.). Upon power up or module reset each relay defaults to the position with common connected to Normally Closed. Even numbered module commands (0, 2, 4, 6, 8) correspond with a set position where the Normally Open contact is connected to Common. Each of the 5 relays responds to a unique even or odd module command number pair. Table 3-4 lists the module commands.

3-37. 2205A-200 Latching Module Commands

3-38. The -200 module has 8 DPST relays. The 8 relays are interconnected in 2 groups of 4 each. The interconnected contacts are labeled Bus A and Bus B. Bus A interconnects relays 0, 1, 2, and 3 and Bus B interconnects relays 4, 5, 6, and 7. Each group of relays function independently. Each group also has a common unswitched guard. All jumpering for matrix configurations is done on the connector card which is factory-wired as two 1X4 matrices. Jumpers may be cut or relocated for custom configurations.

Table 3-4. Actuator Module Commands

| MODULE COMMAND | RELAY AFFECTED | RELAY POSITION |
|----------------|----------------|----------------|
| 0 | 0 | RESET (N.C.)* |
| 1 | 0 | SET (N.O.)** |
| 2 | 1 | RESET (N.C.) |
| 3 | 1 | SET (N.O.) |
| 4 | 2 | RESET (N.C.) |
| 5 | 2 | SET (N.O.) |
| 6 | 3 | RESET (N.C.) |
| 7 | 3 | SET (N.O.) |
| 8 | 4 | RESET (N.C.) |
| 9 | 4 | SET (N.O.) |

*N.C. — Normally Closed

**N.O. — Normally Open

3-39. Module commands 0 through 7 latch the respective relays. Use module commands 8 and 9 to open relays once latched. Module command 8 will open relays 0, 1, 2, and 3. Module command 9 will open relays 4, 5, 6, and 7. A block Reset, "R", will open all latched relays on the addressed module. Table 3-5 lists the module commands.

3-40. 2205A-300 General Purpose Scanner Module Commands

3-41. The -300 module has 10 two wire channels. Each channel is connected to the mainframe scanning bus by the module command corresponding to that channel, 0 to 9. When a channel is closed any other scanner channel on that card or any other in that system will open. Only one scanner channel may be closed at any one time. A reset will open any closed scanning channel.

3-42. 2205A-600 Low Level Scanner Module Commands

3-43. The -600 module provides 10 channels of 3 wire switching which are programmed in the same way as the -300 General Purpose Scanner Module. Table 3-6 lists the commands for both the -300 and the -100.

3-44. 2205A-400 Four-wire Resistance Scanner Module Commands

3-45. The -400 option consists of a source module and a sense module with 10 channels each. The SENSE module is in an even numbered block address. The SOURCE module is in an odd numbered block address. The 2205A needs to be configured to 4 wire mode by manually switching the 2/4 wire switch. In 4 wire mode with each even block command 2 relays close, one per card. Odd Block commands only close the relay being called.

3-46. Scanning in 4 wire mode is achieved by programming the EVEN blocks (Sense modules) only. Programming ODD blocks (Source modules) will not result in 4 wire operation. Table 3-7 lists the module commands.

Table 3-5. Latching Module Commands

| MODULE COMMAND | RELAY AFFECTED | RELAY POSITION |
|----------------|----------------|----------------|
| 0 | 0 | LATCHED |
| 1 | 1 | LATCHED |
| 2 | 2 | LATCHED |
| 3 | 3 | LATCHED |
| 4 | 4 | LATCHED |
| 5 | 5 | LATCHED |
| 6 | 6 | LATCHED |
| 7 | 7 | LATCHED |
| 8 | 0, 1, 2, 3 | OPEN/RESET |
| 9 | 4, 5, 6, 7 | OPEN/RESET |

Table 3-6. General Purpose and Low Level Scanner Module Commands

| MODULE COMMAND | CHANNEL AFFECTED | CHANNEL CONNECTED |
|-------------------|---------------------|----------------------|
| 0 | 0 | 0 |
| 1 | 1 | 1 |
| 2 | 2 | 2 |
| 3 | 3 | 3 |
| 4 | 4 | 4 |
| 5 | 5 | 5 |
| 6 | 6 | 6 |
| 7 | 7 | 7 |
| 8 | 8 | 8 |
| 9 | 9 | 9 |

3-47. SPECIAL SCANNING COMMANDS

3-48. The 2205A can be programmed to set upper and lower boundaries for a sequential scanning loop. The default boundaries are 0 and 99. The manual auto scan mode cannot be remotely programmed. When configured for 4 wire mode the scanning boundaries must be set within an even block address.

3-49. Three commands set the upper and lower boundaries, and increment through the addresses:

1. "mB0" sets the lower boundary. Where m is a number between 0 and 999, representing the lower address.
2. "nB1" sets the upper boundary. Where n is a number between 0 and 999, representing the upper address.
3. Each time a "+" is received, the 2205A increments to the next sequential address. If an address is not selected, (Err) is displayed and the command is ignored.

3-50. When the 2205A has been incremented to the upper boundary, on the next increment command the 2205A steps the address equal to the lower boundary. It steps to the lower boundary, counts up to address 999, loops to 0, and increments up until it reaches the upper boundary, then steps to the lower boundary again.

3-51. IEEE-488 COMPATIBLE INTERFACE (Option -050)

3-52. The IEEE-488 Compatible Interface is designed to meet the intent and requirements of the IEEE-488 1978 Standard. Once installed, it requires no operator attention other than identification of the IEEE-488 listen address code. Table 3-3 lists the 2205A control sequences and their corresponding ASCII control characters. After the interface is addressed, the 2205A will respond to subsequent control characters. Section 7 includes a

detailed description of the IEEE-488 Compatible Interface Option. The commands are described below.

3-53. IEEE-488 UNIVERSAL COMMANDS

3-54. The 2205A is a listen only device. It will never output any data to the bus. The 2205A responds only to the following Universal Bus Commands. All other commands are ignored.

3-55. MLA - My Listen Address

3-56. When the 2205A detects its listen address (0 to 30 set by the IEEE address switch) it goes into remote (the front panel remote indicator turns on). Note that the 2205A will not handshake data if it is in the manual auto scan mode.

3-57. UNL - Unlisten

3-58. The 2205A stops listening when it receives the unlisten command. It will not respond to data until it has been addressed as a listener again.

3-59. LLO - Local Lockout

3-60. When it receives the Local Lockout command, the 2205A locks out (disables) the front keyboard including the LOCAL key.

3-61. DCL - Device Clear

3-62. The 2205A resets all modules and clear the display when it receives the Device Clear command. This has the same effect as the "*" or "\$" commands.

3-63. SDC - Selected Device Clear

3-64. The 2205A resets in response to the SDC only when it has been addressed as a listener. It resets all modules and clear the display. This has the same effect as the "*" or "\$" commands.

3-65. RS-232-C INTERFACE OPTION -060

3-66. The RS-232-C Interface is designed to meet the intent and requirements of the Electronic Industries Association Standard RS-232-C. Once installed, it requires no operator attention other than verification of the baud rate. This appears on the display when the 2205A is initially energized. Section 2-33 discusses display indications for the various baud rates. Section 7 includes a detailed description of the RS-232-C Interface Option. The RS-232-C commands are described below.

3-67. RS-232-C SERIAL DATA COMMANDS

3-68. When the 2205A receives data via the RS-232C interface it goes into remote and the front panel remote indicator turns on. There are two additional commands which are used only with the RS-232C interface to provide local lockout capability: L and L0. The 2205A locks out (disables) the front panel, including the LOCAL key, when it receives the "L" via the RS-232C interface. The 2205A unlocks the front panel when a "L0" is received. To resume local control press the LOCAL key.

Table 3-7. Four-Wire Resistance Scanner Module Commands.

| BLOCK # | MODULE COMMAND | CHANNEL # | SENSE | SOURCE |
|---------|----------------|-----------|--------|--------|
| EVEN | 0 | 0 | CLOSED | CLOSED |
| EVEN | 1 | 1 | CLOSED | CLOSED |
| EVEN | 2 | 2 | CLOSED | CLOSED |
| EVEN | 3 | 3 | CLOSED | CLOSED |
| EVEN | 4 | 4 | CLOSED | CLOSED |
| EVEN | 5 | 5 | CLOSED | CLOSED |
| EVEN | 6 | 6 | CLOSED | CLOSED |
| EVEN | 7 | 7 | CLOSED | CLOSED |
| EVEN | 8 | 8 | CLOSED | CLOSED |
| EVEN | 9 | 9 | CLOSED | CLOSED |
| ODD | 0 | 0 | OPEN | CLOSED |
| ODD | 1 | 1 | OPEN | CLOSED |
| ODD | 2 | 2 | OPEN | CLOSED |
| ODD | 3 | 3 | OPEN | CLOSED |
| ODD | 4 | 4 | OPEN | CLOSED |
| ODD | 5 | 5 | OPEN | CLOSED |
| ODD | 6 | 6 | OPEN | CLOSED |
| ODD | 7 | 7 | OPEN | CLOSED |
| ODD | 8 | 8 | OPEN | CLOSED |
| ODD | 9 | 9 | OPEN | CLOSED |

3-69. Operating Conditions

3-70. There are eight conditions that should be taken into consideration when operating the 2205A:

1. Rapid successive power-on/power-off switching can cause the 2205A to lockup. A slow power-off/power-on sequence clears the lockup condition.

2. Multiple ENTER commands should be used with care. An even number of enter commands followed by a digit sets a boundary. An odd number of enter commands followed by a digit causes the digit to be displayed.

3. The data that appears on the CHANNEL DISPLAY is dim until the ENTER button is pressed. This indicates a standby condition.

4. When selecting an upper boundary, any digit other than 0 (zero) should be used.

5. A channel within the auto increment range must be selected to start the auto increment sequence. If a channel higher than the range is selected, scanning begins at that channel and increments up to channel 999, rolls over to channel 0, and increments up to the upper boundary. If a channel lower than the range is selected, scanning begins at that channel and increments up to the upper boundary.

6. With the exception of entering the auto increment mode, simultaneous keyboard entries are undefined.

7. IEEE-488 data will not be recognized while the 2205A is in auto increment operation. The 2205A does not handshake the information sent, and does not act on it.

8. If a remote interface is not installed in the 2205A, and the auto increment rate is set to 3.3 seconds (slowest rate), the unit displays Err (error) on power up. Ignore the error message.

3-71. OPERATION

3-72. Use the following procedure to operate the 2205A:

1. Energize the 2205A by pressing the POWER switch.

2. Observe the CHANNEL DISPLAY and verify the displayed baud rate (RS-232-C) or listen address (IEEE-488).

3. Enter control data using either local or remote input. If local control is desired after a remote control sequence, press the LOCAL switch before attempting to enter data. See Table 3-1 for a complete list of manual control functions. See Table 3-3 for equivalent remote control sequences.

Section 4

Theory of Operation

4-1. INTRODUCTION

4-2. This section of the manual contains an overall functional description followed by a block diagram analysis of the Model 2205A Switch Controller. Simplified diagrams are used to support the block diagram analysis. Detailed schematics of individual pcb assemblies are given in Section 9.

4-3. OVERALL FUNCTIONAL DESCRIPTION

4-4. The 2205A, as shown in Figure 4-1, is a controller mainframe complete with power supply, room for up to 10 switching modules (10 channels per module), the logic necessary for local operation, and the front panel controls and indicators necessary for a man/machine interface. It is designed to provide controlled sequential or random access to external analog data (via the rear connector terminals) for measurement purposes and/or a variety of switching functions.

4-5. Functionally, the 2205A is a programmable, 100 channel controller (when a total of 10 optional scanner or switch modules are installed) that is electrically capable of being expanded up to 1000 channels, using a series of (up to nine) Extender Chassis (Models 2201A or 2202A). Internal microprocessor based logic allows a scan sequence to be either manually or remotely defined, displayed, and incremented on manual, automatic, or remote command. Analog data to a selected scanner channel is presented to a common internal scanner bus which is electrically accessible via a rear panel connector. Normally, the bus is connected to a system type DMM input (Model 8520A is recommended). After a channel is selected, the 2205A generates a Trigger Output pulse. This externally accessible pulse is used to command the DMM to read the analog bus, and thus, the selected analog input channel.

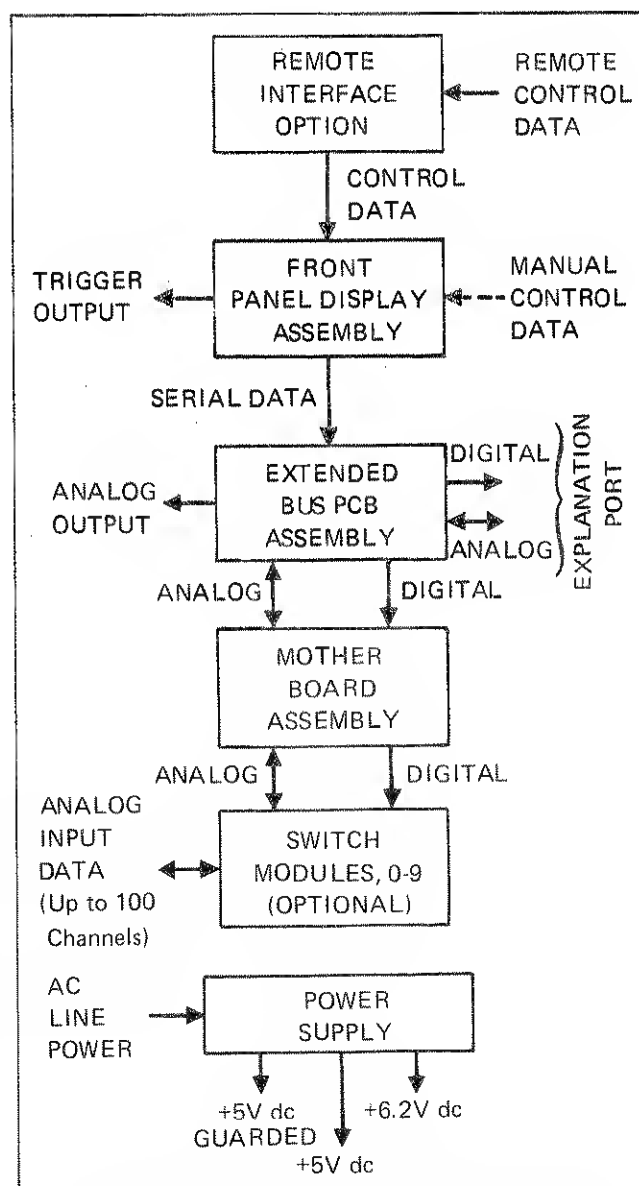


Figure 4-1. 2205A Functional Block Diagram

4-6. BLOCK DIAGRAM ANALYSIS

4-7. Front Panel Display PCB

4-8. The Front Panel Display PCB (Figure 4-2) functions as the data processor for the 2205A. It consists of an 8-bit microcomputer, a system oscillator, an onboard keyboard, a 3-digit display, an output trigger driver, and a set of switches to define the output trigger delay time and remote interface requirements. Program data can be entered manually using the keyboard or remotely by way of the data bus and an interface option (RS-232-C or IEEE-488). Updated channel select

information is presented to the display via an 8-bit register and serially output to the Extended Bus PCB as control data.

4-9. The microcomputer used in the 2205A is a single component device complete with an 8-bit CPU, RAM, and two I/O ports. All switch controller activity is under control of the microcomputer. This includes local and remote data entry, data display, trigger delay, auto increment control and remote interface programming (baud rate, IEEE address, or auto increment rate).

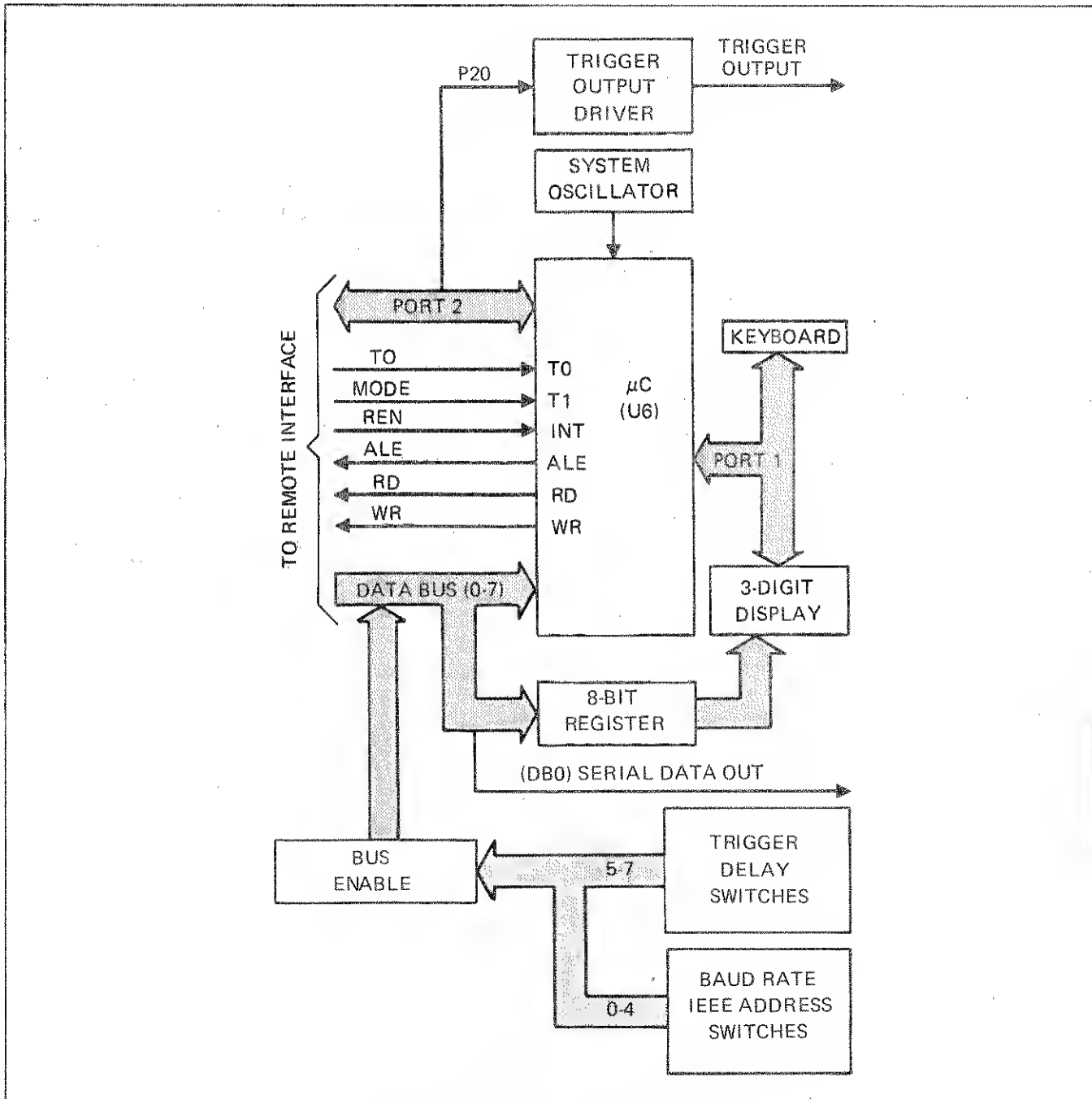


Figure 4-2. Front Panel Display PCB

4-10. System control data leaving the Front Panel Display PCB is limited to bit-serial channel selection data (14 characters) and an output trigger. Channel selection data is stored as a 12-bit parallel word on the Extended Bus PCB where it is used to energize the selected channel (000-999). A predetermined (switch selected) delay is initiated when a channel selection is made. At the end of the delay (i.e., after the break-before-make switching is complete), an output trigger is generated to enable the DMM to make a measurement of the analog signal from the selected channel.

4-11. Extended Bus PCB

4-12. The Extended Bus PCB (Figure 4-3) is designed to store, decode, and distribute the digital channel select

data received from the Front Panel Display PCB. The extended bus consists of a pair of dual shift registers, three 4-bit latches, a 1-of-10 decoder, a 4-bit multiplexer, and a pair of analog switching relays. Incoming serial data is entered into the serial data register as a 12-bit data word preceded by two fixed start bits (1 and 0). When the first bit (1) is shifted into the fourteenth position a transfer command is generated to load the 12 parallel data outputs of the serial registers into the parallel data register. The parallel data output is used to provide channel select commands to both the local switch modules and the extender chassis. This dual register technique is known as double buffering. It is used to prevent the switch modules from responding while new data is being entered into the serial register.

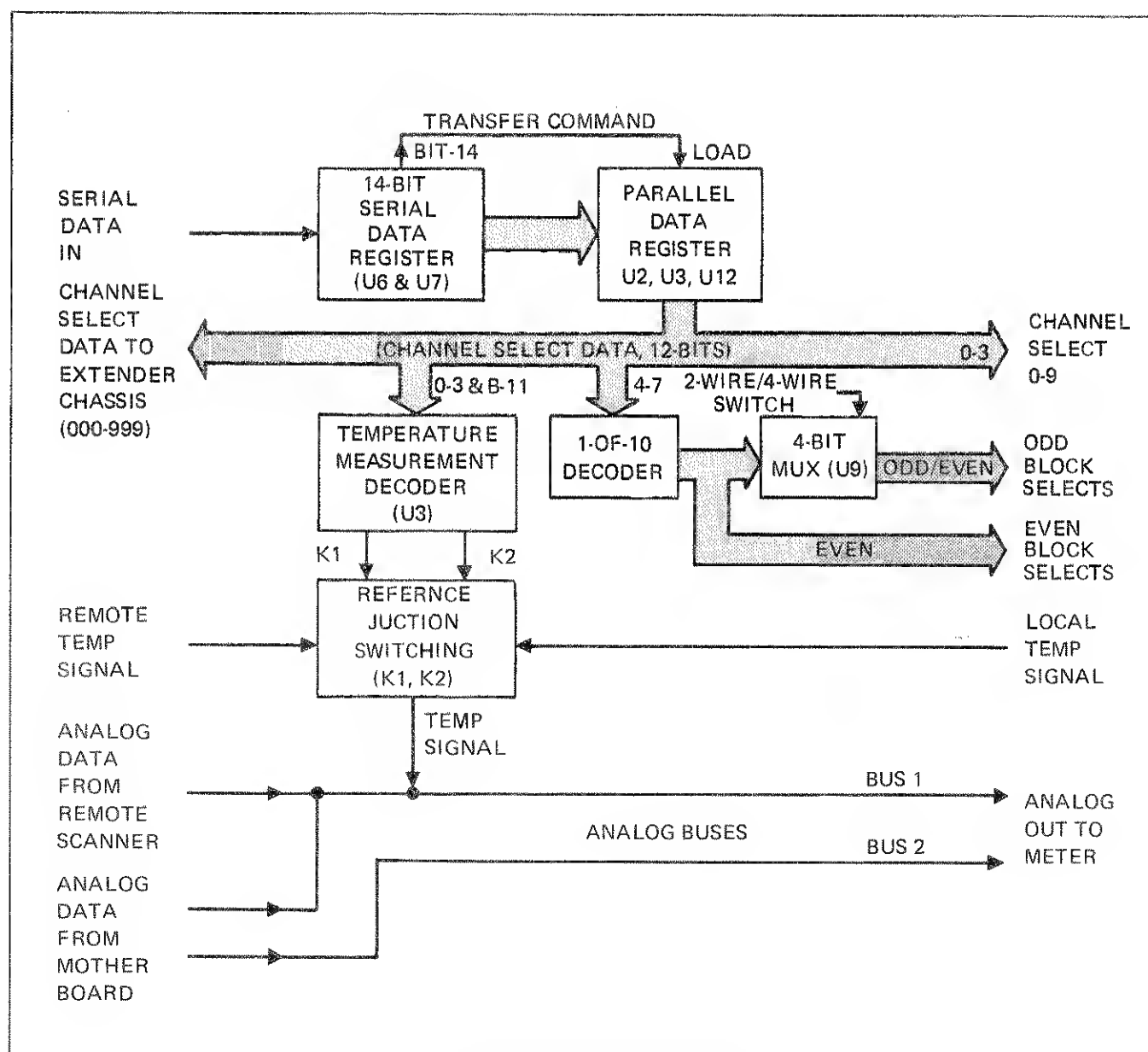


Figure 4-3. Extended Bus PCB

4-13. The 12-bits of channel select data are divided into three bcd command groups; units, tens, and hundreds. These lines are buffered and output to the Extender Cable I/O connector for use in commanding external channels (100 to 999). Internally, the channel select lines are used to control channels 0 through 99. Lines 0 through 4 are buffered and used as bcd channel select commands 0 through 9. Lines 5 through 9 are decoded into 10 discrete controls lines (Block Select 0-9) for selecting one of the 10 possible internal switch modules. When four-wire operation is required one of the even numbered slots (0, 2, 4, 6, 8) and the next higher odd numbered slot are enabled simultaneously. This is accomplished by a four bit multiplexer which supplies either even or odd commands to the odd numbered switch module blocks. An internal switch setting (two-wire/four-wire) controls the multiplexer's operation.

4-14. Thermocouple temperature measurements are made using special low level scanner modules. The modules are equipped with the ability to sample a reference junction plus the standard 10-channel scanning capability. To make an accurate temperature determination both the thermocouple output and the temperature at the thermocouple connections (reference junction) must be measured. The controls needed to accomplish this two step measurement are included on the Extender Bus PCB in the form of the temperature measurement decoder and two reference junction relays. Relay K1 selects between local (within the 2205A) or remote (within the extender chassis) reference temperature signals. Relay K2 is closed when the microcomputer determines the need for a reference junction measurement. This places the local or remote reference as selected by K1 onto the analog bus for measurement purposes. Relay K2 is always open for channel data measurements.

4-15. Measurement data from the selected switch module input channel or reference junction (local or remote) is presented to the analog bus on the Extended Bus PCB. Measurement connections for the external measurement device (DMM) are taken directly from the bus and made available at the ANALOG CABLE OUTPUT connector.

4-16. Power Supply

4-17. The power supply provides the operating voltages for the 2205A with a full complement of switch modules.

Voltages include +5V for the guarded logic (GL+5V), +5V for the unguarded logic (UL+5V), and the 6.2V reference voltage required for thermocouple temperature measurements.

4-18. Input power for the power supply is derived from a 100/120/220/240V ac transformer with three secondary windings. Transformer line requirements are selectable by changing the position of a plug-in pcb located in the rear panel fuse compartment. A transformer shield isolates two of the output windings. This shield is extended to the power supply pcb and the 2205A mainframe where it is used for signal isolation (guard). Guarded voltages includes GL+5V and +6.2V reference.

4-19. Logic Common for the guarded +5V supply is 15 volts below analog common and guard. This allows the FETs on the scanning modules to be switched directly. The +6.2V supply uses Reference Common as its ground return. Reference Common is tied directly to A/D Common. The unguarded +5V supply has a floating ground that is referenced to the 2205A chassis when a system controller is used. If a system controller is not used, internal zener diodes keep the common from floating. The unguarded common is also accessible at the shell of the Trigger Output connector on the rear of the 2205A. When the Trigger Output is used, the shell (unguarded common) should not be floated more than 30 volts above chassis.

4-20. Conventional regulating techniques are used in both sections of the power supply. Three terminal IC regulators are used for both +5V supplies and no adjustments are provided. The +6.2V supply is adjustable. It uses a unity gain op-amp whose adjustable input is derived from a regulated zener reference.

4-21. Remote Interface Options

4-22. Two remote interface options are available for use with 2205A; the IEEE-488 Compatible Interface (Option -050) and the RS-232-C Interface (Option -060). Both interfaces are receive-only devices. The IEEE-448 Interface conforms to the IEEE-488, 1978 Standard and is used to receive character-serial control data. The RS-232-C Interface is used to receive bit-serial input data conforming to the EIA RS-232-C Standard. Theory for each interface assembly is given in Section 7 of this manual.

Section 5 Maintenance

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

5-1. INTRODUCTION

5-2. This section of the manual contains maintenance information for the Model 2205A Switch Controller including general maintenance and a performance test. The performance test is recommended as an acceptance test when the instrument is first received and later, as a calibration procedure to periodically verify specifications. The 2205A does require one calibration adjustment. Table 5-1 lists the equipment required for servicing the instrument. If the recommended model is not available, a substitute meeting the minimum use specifications may be used.

5-3. SERVICE INFORMATION

5-4. The 2205A is warranted for a period of 1-year upon delivery to the original purchaser. The WARRANTY is located on the back of the title page located in the front of this manual.

5-5. Factory Authorized calibration and service for each Fluke product is available at various worldwide locations. A complete list of these service centers is included at the rear of this manual. If requested, an estimate will be provided to the customer before work is begun on instruments that are beyond the warranty period.

5-6. GENERAL MAINTENANCE

5-7. Cleaning

5-8. Clean the 2205A periodically to remove dust, grease and other contamination. Use the following procedure:

CAUTION

Do not use aromatic hydrocarbons or chlorinated solvents to clean the 2205A. They will react with the plastic materials used in the instrument.

Table 5-1. Required Test Equipment

| INSTRUMENT TYPE | REQUIRED CHARACTERISTICS | RECOMMENDED MODEL |
|-----------------|-----------------------------------|-------------------|
| DMM | 20V dc range $\pm 0.1\%$ accuracy | Fluke 8520A |
| SCANNING MODULE | 10-channel | Fluke 2205A-610K |
| TEST CABLE | See Set-up Procedure | Fabricate |

1. Clean the front panel and case with a soft cloth dampened with a mild solution of detergent and water.
2. Clean the surface of the pcbs using clean, dry air at low pressure (<20 psi). If grease is encountered, spray with Freon T.F. Degreaser and remove grime with dry, low-pressure air.

5-9. PERFORMANCE TEST

5-10. The performance test is designed to verify the overall operation of the 2205A, and is intended for use as an acceptance test and/or periodic maintenance check. The equipment used in the test is specified in Table 5-1. If the 2205A fails any part of the performance test, corrective action is required.

5-11. Set-Up Procedure

5-12. Before attempting to execute any of the performance test procedures complete the following set-up procedure:

1. Fabricate a test cable using a isothermal block input connector (2205A-008); two 24-inch lengths of 20-gauge insulated copper wire (red, black); ten 1/4 watt, 1% resistors; and a 36-pin male connector (Fluke Part Number 417378). Assemble the cable as shown in Figure 5-1.
2. Disconnect the 2205A from the line power.
3. Remove the top cover, the rear panel enclosure, and the guard chamber top for the duration of the performance test.
4. Install a scanning pcb in slot 0 (channels 0-9) of the 2205A.
5. Remove all other modules and input connectors from the remaining slots.
6. Attach the test cable to the scanning module in slot 0. Connect the male cable connector end to the rear panel EXTENDER CABLE I/O connector.
7. Select the two-wire configuration by setting the S1 switch on the Extender Bus PCB to the 2-wire position.
8. Connect a DMM to the 2205A (use a two-wire bus) by way of the rear panel ANALOG CABLE OUTPUT connector.
9. Set the DMM to the 20V dc range.
10. Connect the 2205A to line power and press the POWER switch to ON. The channel display should indicate the assigned baud rate (b0-b7) or the assigned IEEE-488 address (A0 thru A31), as applicable.

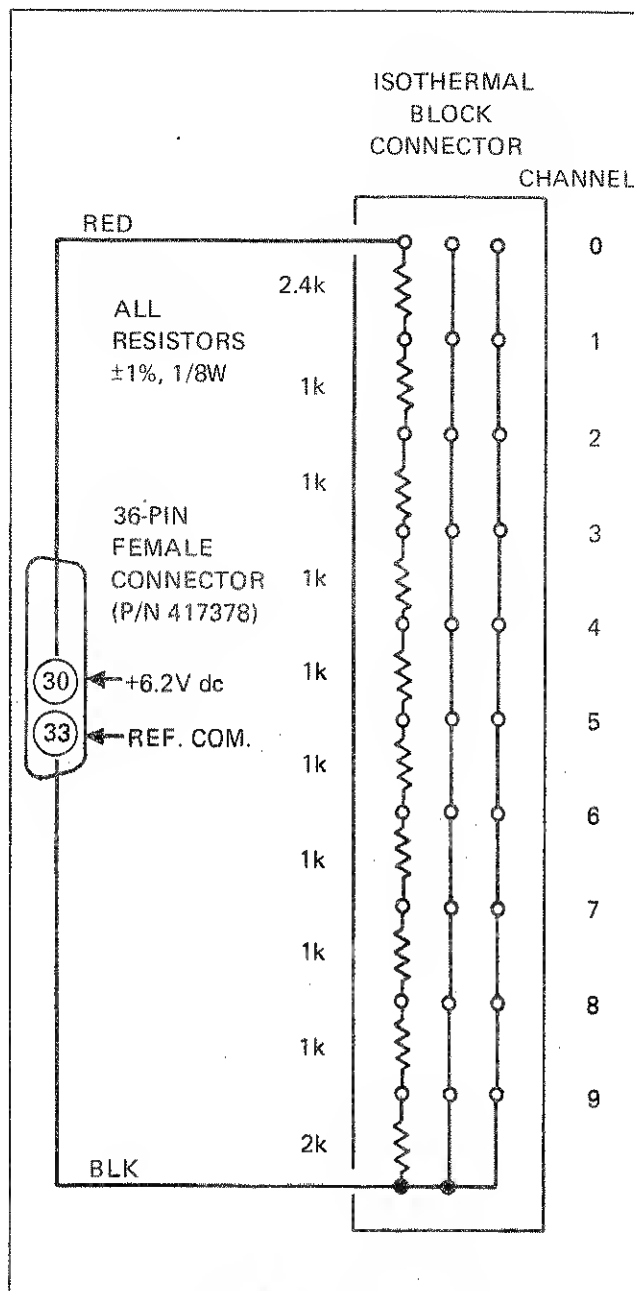


Figure 5-1. Test Cable

5-13. Manual Test Procedure

5-14. Manually test the overall operation of the 2205A using the following procedure:

1. Using the front panel keyboard, manually call channel 9 (press 9 and ENTER). The DMM display should read 6.200 ± 0.001 V dc. If the voltage is out of tolerance, the supply must be adjusted. See CALIBRATION ADJUSTMENTS later in this section.
2. Select channel 0. The DMM should read 1.50 ± 0.03 V dc.

3. Scan channels 0 through 9 using the INCREMENT switch. The DMM reading at each channel should be as follows:

| Channel | Vdc Reading |
|---------|-------------------|
| 0 | 1.00 \pm 0.03 |
| 1 | 1.50 \pm 0.03 |
| 2 | 2.00 \pm 0.03 |
| 3 | 2.50 \pm 0.03 |
| 4 | 3.00 \pm 0.03 |
| 5 | 3.50 \pm 0.04 |
| 6 | 4.00 \pm 0.04 |
| 7 | 4.50 \pm 0.05 |
| 8 | 5.00 \pm 0.05 |
| 9 | 6.200 \pm 0.001 |

4. Set the POWER switch to OFF and move the test cable and scanning module to slot 1.

5. Energize the 2205A and manually scan channels 10 through 19. The DMM readings should agree with those shown in step 3 of this procedure.

6. Using steps 3, 4, and 5 of this procedure, check the operation of slots 2 through 9.

7. With the module in slot 9, press 90 followed by T.C. REF JUNCTION. The DMM should read between 0.4 and 0.6V dc at an ambient room temperature of 25°C.

5-15. Baud Rate/IEEE Address

5-16. The following procedure tests the operation of the baud rate/IEEE address switch (S1 on the Front Panel Display PCB). Switch S1 is a set of five switches located on the Front Panel Display PCB. The switch is accessible when the 2205A's top dust cover is removed. Conduct the test as follows:

1. Set the 2205A POWER switch to OFF.
2. Set all five S1 switches to the ON (closed) position.
3. Set the POWER switch the ON. The display should read A0 if the IEEE Compatible Interface is installed or b0 for the RS-232-C Interface.
4. Verify the remaining switch positions as follows:
 - a. If the IEEE Compatible Interface is installed, sequentially set switches 1 through 5 to the open position. Switch power off and on at each setting and observe the display. The reading for each setting should agree with the following list:

Switch: 1 2 3 4 5
Display: A1 A2 A4 A8 A16

b. If the RS-232-C Interface is installed, sequentially set switches 1 through 3 (4 and 5 are not used) to the open position. Switch power off and on at each setting and observe the display. The reading for each setting should agree with the following list:

Switch: 1 2 3
Display: b1 b2 b4

5-17. Remote Interface Test Procedure

5-18. The following procedure is used to test the remote interface portion of the 2205A. Refer to Section 3 of this manual for programming information. See Section 7 for interface requirements of the IEEE-488 Compatible and RS-232-C Interface options.

1. Perform the set-up procedure given earlier in this section.
2. Select the appropriate baud-rate/IEEE address using the procedure described in the Installation section of this manual.
3. Refer to the Manual Test Procedure given earlier in this section and execute it using remote commands.

5-19. CALIBRATION ADJUSTMENT

5-20. The 2205A is equipped with a calibration adjustment (R2) on the Power Supply PCB. This potentiometer is used to adjust the +6.2V dc reference voltage used in making thermocouple temperature measurements. Use the following procedure to adjust R2:

1. Complete the set-up procedure given earlier in this section under Performance Test.
2. Remove the top cover using the Access Procedure given earlier in Section 2.
3. Using the front panel keyboard, manually call channel 9 (press 9 and ENTER). The DMM should read 6.200 0.001V dc. If the voltage is out of tolerance, adjust R2 for a reading of 6.200V dc.
4. Re-install the top cover.

5-21. TROUBLESHOOTING

CAUTION



Static discharge can damage MOS components contained in the 2205A.

5-22. When troubleshooting or repairing the 2205A use the following precautions to prevent damage from static discharge:

1. Never remove, install or otherwise connect or

disconnect components or pcbs without first setting the 2205A POWER switch to OFF.

2. Perform all repairs at a static-free work station.
3. Do not handle IC's or pcbs by their connectors.
4. Use static ground straps to discharge repair personnel.
5. Use conductive foam to store replacement or removed IC's.
6. Remove all plastic, vinyl and styrofoam products from the work area.

7. Use a grounded soldering iron.

5-23. A troubleshooting guide for the 2205A is given in Table 5-2. To properly use the guide, complete the performance test given earlier in this section and note any discrepancies. Then locate the heading of the procedure in question in the Test and Symptom column. Under that heading isolate the symptom that approximates the observed malfunction. Possible causes are listed to the right of the selected symptom. Details necessary to isolate a particular cause can be derived from the theory of operation in Section 4 and the schematic diagrams in Section 9 of this manual.

Table 5-2. Troubleshooting Guide

| TEST AND SYMPTOM | POSSIBLE CAUSE |
|---|---|
| <p>SET-UP PROCEDURE Display Blank</p> <p>MANUAL TEST PROCEDURE Channels 0 through 9 No +6.2V reading</p> <p>+6.2V reads OK; one or more of other voltages are incorrect</p> <p>Some block slots are OK others are not</p> <p>Baud Rate/IEEE-Address</p> | <p>Fuse, power supply, power supply cable and connections, system clock, microcomputer U6.</p> <p>Power Supply, Extender PCB Assembly, Motherboard.</p> <p>Extender PCB channel select logic, Motherboard.</p> <p>Extender Bus PCB block select logic, Motherboard.</p> <p>All baud rate/IEEE address malfunctions can be isolated to the Front Panel Display PCB Assembly.</p> |

Section 6

List of Replaceable Parts

TABLE OF CONTENTS

| ASSEMBLY NAME | TABLE NO. | PAGE | FIGURE NO. | PAGE |
|---|--------------|------|---------------|------|
| 6070A/6071A Final Assembly | 6-1 | 6-3 | 6-1 | 6-5 |
| A1 Front Panel Display PCB Assembly | 6-2 | 6-8 | 6-2 | 6-10 |
| A2 Motherboard PBC Assembly | 6-3 | 6-11 | 6-3 | 6-11 |
| A3 Power Supply PCB Assembly | 6-4 | 6-12 | 6-4 | 6-13 |
| A4 Extender Bus PCB Assembly | 6-5 | 6-14 | 6-5 | 6-15 |

6-1. INTRODUCTION

6-2. This section contains an illustrated parts breakdown of the instrument. A similar parts list is included in the Options and Accessories Section for each of the options. Components are listed alphanumerically by assembly. Both electrical and mechanical components are listed by reference designation. Each listed part is shown in an accompanying illustration.

6-3. Parts lists include the following information:

1. Reference Designation.
2. Description of Each Part.
3. FLUKE Stock Number.
4. Federal Supply Code for Manufacturers.
5. Manufacturer's Part Number.
6. Total Quantity of Components Per Assembly.
7. Recommended quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of 2 years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for 1 year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked. In the case of optional subassemblies, plug-ins, etc., that are not always part of the instrument or are deviations from the basic instrument model, the REC QTY column lists the recommended spares quantity for the items in that particular assembly.

6-4. HOW TO OBTAIN PARTS

6-5. Components may be ordered directly from the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. or an authorized representative by using the FLUKE STOCK NUMBER. In the event the part ordered has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions if necessary.

6-6. To ensure prompt and efficient handling of your order, include the following information.

1. Quantity.
2. FLUKE Stock Number.
3. Description.
4. Reference Designation.
5. Printed Circuit Board Part Number and Revision Letter.
6. Instrument Model and Serial Number.

6-7. A Recommended Spare Parts Kit for your basic instrument is available from the factory. This kit contains those items listed in the REC QTY column for the parts lists in the quantities recommended.

6-8. Parts price information is available from the John Fluke Mfg. Co., Inc. or its representative. Prices are also available in a Fluke Replacement Parts Catalog, which is available upon request.

CAUTION

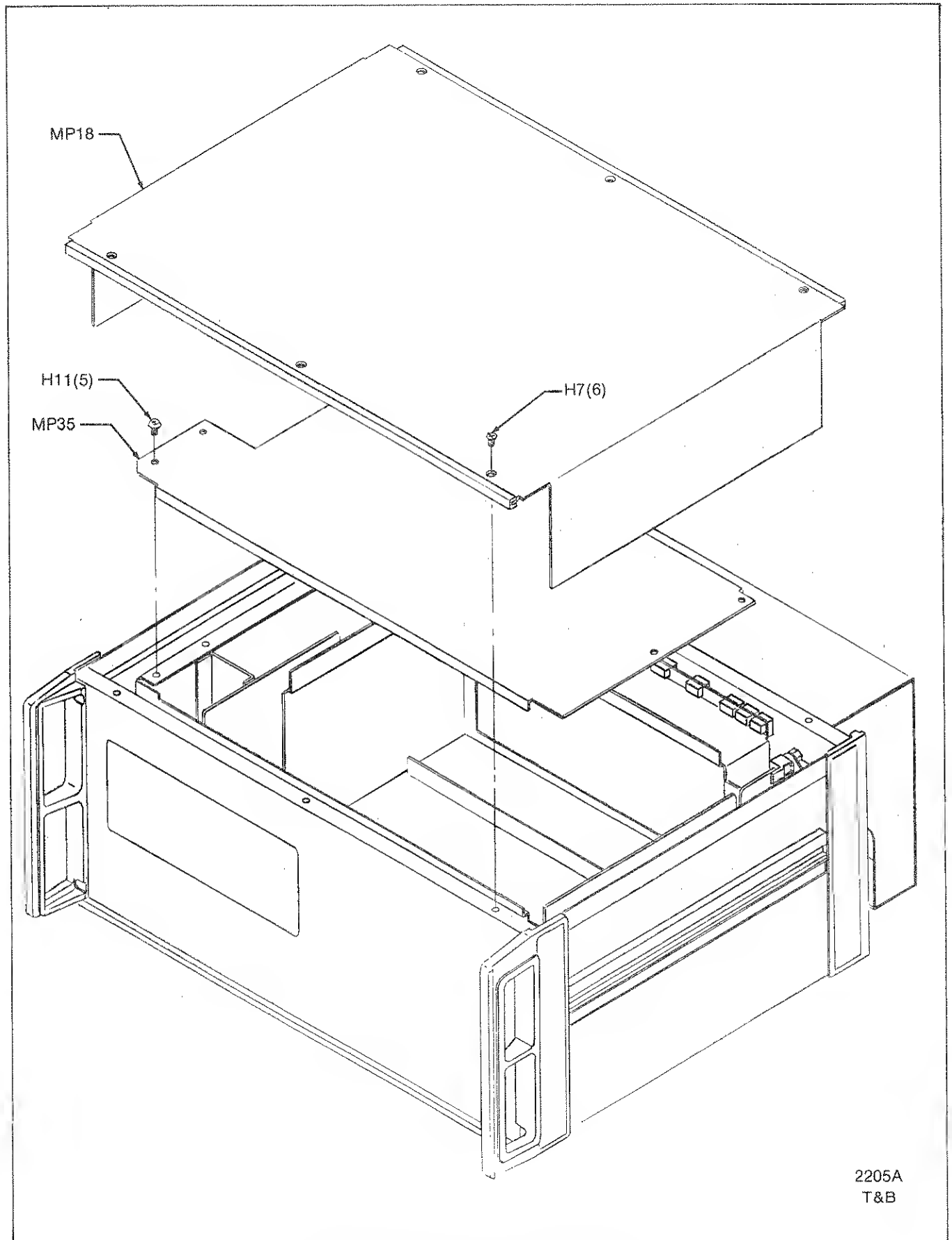
Indicated devices are subject to damage by static discharge.

Table 6-1. 6070A/6071A Final Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|---|-----------------------|---------------------|--------------|------------|------------|------------------|
| | FINAL ASSEMBLY, MODEL 2205A FIGURE 6-1 (2205A-5001, T&B) | | | | | | |
| A1Ⓢ | FRONT PANEL DISPLAY ASSEMBLY | 639708 | 89536 | 611061 | 1 | | |
| A2 | MOTHER BOARD PCB ASSEMBLY | 468132 | 89536 | 468132 | 1 | | |
| A3 | POWER SUPPLY PCB ASSEMBLY | 639690 | 89536 | 611897 | 1 | | |
| A4Ⓢ | EXTENDED BUS PCB ASSEMBLY | 639716 | 89536 | 611087 | 1 | | |
| F1 | FUSE, SLO-BLO, 1/4 AMP | 166306 | 71400 | MDL1-4 | 1 | | |
| F2 | FUSE, 1/2 AMP, 125V (NOT SHOWN) | 603274 | 71400 | GFA | 8 | | |
| H1 | NUT, HEX 2-56 | 110668 | 89536 | 110668 | 4 | | |
| H2 | NUT, HEX 28-1/4 | 110619 | 89536 | 110619 | 1 | | |
| H3 | SCREW, 2-56 X 5/8 | 370270 | 89536 | 370270 | 4 | | |
| H4 | SCREW, PHP 4-40 X 1/4 | 185918 | 89536 | 185918 | 19 | | |
| H5 | SCREW, SEMS 4-40 X 3/8 | 281196 | 89536 | 281196 | 2 | | |
| H6 | SCREW, PHP 6-32 X 1/4 | 385401 | 89536 | 385401 | 11 | | |
| H7 | SCREW, FH, UC, 6-32 X 1/4 | 320093 | 89536 | 320093 | 6 | | |
| H8 | SCREW, PHP 6-32 X 1/2 | 177022 | 89536 | 177022 | 4 | | |
| H9 | SCREW, FH, UC 6-32 X 1/2 | 320093 | 89536 | 320093 | 10 | | |
| H10 | SCREW W/LOCKWASHER, 6-32 X 3/8 | 177022 | 89536 | 177022 | 22 | | |
| H11 | SCREW, PHP, 6-32 X 3/8 | 334458 | 89536 | 334458 | 5 | | |
| H12 | SCREW, CAP 8-32 X .375 | 295105 | 89536 | 295105 | 4 | | |
| H13 | SCREW, PHP 8-32 X 1/4 | 228890 | 89536 | 228890 | 4 | | |
| H14 | SCREW, FHP 8-32 X 1/2 | 114355 | 89536 | 114355 | 6 | | |
| H15 | SCREW, FHP 8-32 X 3/8 | 114116 | 89536 | 114116 | 12 | | |
| H16 | LOCKWASHER #2 | 110676 | 89536 | 110676 | 4 | | |
| MP1 | BAIL, STANDFOOT | 292870 | 89536 | 292870 | 4 | | |
| MP2 | BRACKET, GUARD | 468686 | 89536 | 468686 | 1 | | |
| MP3 | BRACKET, POWER SUPPLY | 467886 | 89536 | 467886 | 1 | | |
| MP4 | BRACKET, GUARD | 467944 | 89536 | 467944 | 1 | | |
| MP5 | BRACKET, SUPPORT, ISOTHERMAL | 440529 | 89536 | 440529 | 1 | | |
| MP6 | BINDING POST, BRASS | 225623 | 20584 | 3576 | 1 | | |
| MP7 | BINDING POST | 225615 | 20584 | 3575 | 1 | | |
| MP8 | BUSHING, NYLON | 339978 | 89536 | 339978 | 1 | | |
| MP9 | GUIDE, CARD 4 1/2 X .312 | 256461 | 23880 | 1450F | 11 | | |
| MP10 | GUIDE, CARD | 298836 | 89536 | 298836 | 31 | | |
| MP11 | BUTTON, POWER SWITCH | 401646 | 89536 | 401646 | | | |
| MP12 | BUMPER, RUBBER | 423442 | 70485 | 1178-2 | 4 | | |
| MP13 | GUARD, BOTTOM CHAMBER | 467951 | 89536 | 467951 | 1 | | |
| MP14 | GUIDE, CARD 2 1/2 X .312 | 295022 | 23880 | 1250F | 1 | | |
| MP15 | CHANNEL, BLK RUBBER | 404665 | 77969 | 539 | 1 | | |
| MP16 | CONNECTOR, LINE CORD | 461269 | 05245 | 6J1 | 1 | | |
| MP17 | COVER, EXTENDER I/O | 632117 | 89536 | 632117 | 1 | | |
| MP18 | COVER, TOP | 526814 | 89536 | 526814 | 1 | | |
| MP19 | COVER, REAR | 632125 | 89536 | 632125 | 1 | | |
| MP20 | CORNER, MODIFIED | 471375 | 89536 | 471375 | 2 | | |
| MP21 | COVER, BOTTOM GRAY | 526882 | 89536 | 526882 | 1 | | |

Table 6-1. 6070A/6071A Final Assembly (cont)

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | NOTE |
|------------|---------------------------------|-----------------------|---------------------|--------------|------------|------------|------|
| MP22 | DECAL, REAR PANEL | 629147 | 89536 | 629147 | 1 | | |
| MP23 | DECAL, FRONT PNL | 605022 | 89536 | 605022 | 1 | | |
| MP24 | HANDLE, FRONT CORNER | 394320 | 89536 | 394320 | 2 | | |
| MP25 | INSULATOR, FASTENER | 372342 | 89536 | 372342 | 25 | | |
| MP26 | LUG, SOLDER | 102566 | 79963 | 813 | 1 | | |
| MP27 | NAMEPLATE, S/N | 472522 | 89536 | 472522 | 1 | | |
| MP28 | FRONT PANEL ASSEMBLY | 468892 | 89536 | 468892 | 1 | | |
| MP29 | PANEL, REAR | 467878 | 89536 | 467878 | 1 | | |
| MP30 | RETAINER, CARD | 468660 | 89536 | 468660 | 1 | | |
| MP31 | BUTTON, POWER SHAFT | 467910 | 89536 | 467910 | 1 | | |
| MP32 | CHASSIS, LEFT SIDE | 618819 | 89536 | 618819 | 1 | | |
| MP33 | CHASSIS, RIGHT SIDE | 419580 | 89536 | 419580 | 1 | | |
| MP34 | SPACER, INSULATED | 372334 | 89536 | 372334 | 25 | | |
| MP35 | GUARD CHAMBER, TOP | 467894 | 89536 | 467894 | 1 | | |
| MP36 | DECAL, HANDLE | 394403 | 89536 | 394403 | 4 | | |
| T1 | TRANSFORMER, POWER | 618884 | 89536 | 618884 | 1 | | |
| TM1 | INSTRUCTION MANUAL, 2205A | 633644 | 89536 | 633644 | | | |
| W1 | CABLE, TRIGGER | 612945 | 89536 | 612945 | 1 | | |
| W2 | CABLE, ANALOG OUTPUT | 612960 | 89536 | 612960 | 1 | | |
| W3 | CABLE, LINE CORD | 611103 | 89536 | 611103 | 1 | | |
| W4 | CABLE, EXTENDER BUS | 612952 | 89536 | 612952 | 1 | | |
| W5 | CABLE, POWER | 611111 | 89536 | 611111 | 1 | | |
| W6 | CABLE, INTERCONNECT (NOT SHOWN) | 468611 | 89536 | 468611 | 1 | | |
| W7 | LINE CORD SET (NOT SHOWN) | 284174 | 89536 | 284174 | 1 | | |
| | RECOMMENDED SPARE PARTS KIT | 641787 | 89536 | 641787 | | | |



2205A
T&B

Figure 6-1. 6070A/6071A Final Assembly

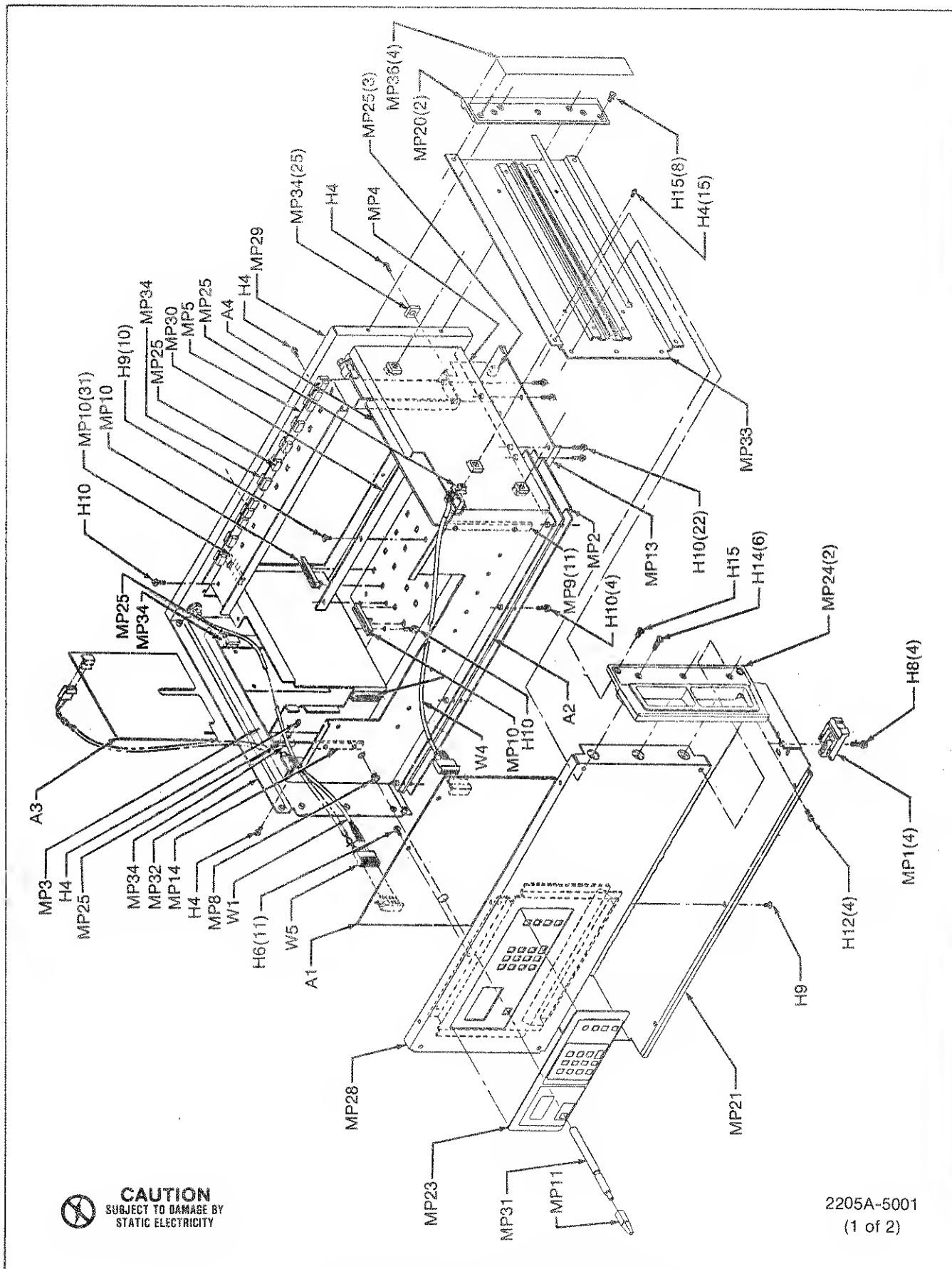


Figure 6-1. 6070A/6071A Final Assembly (cont)

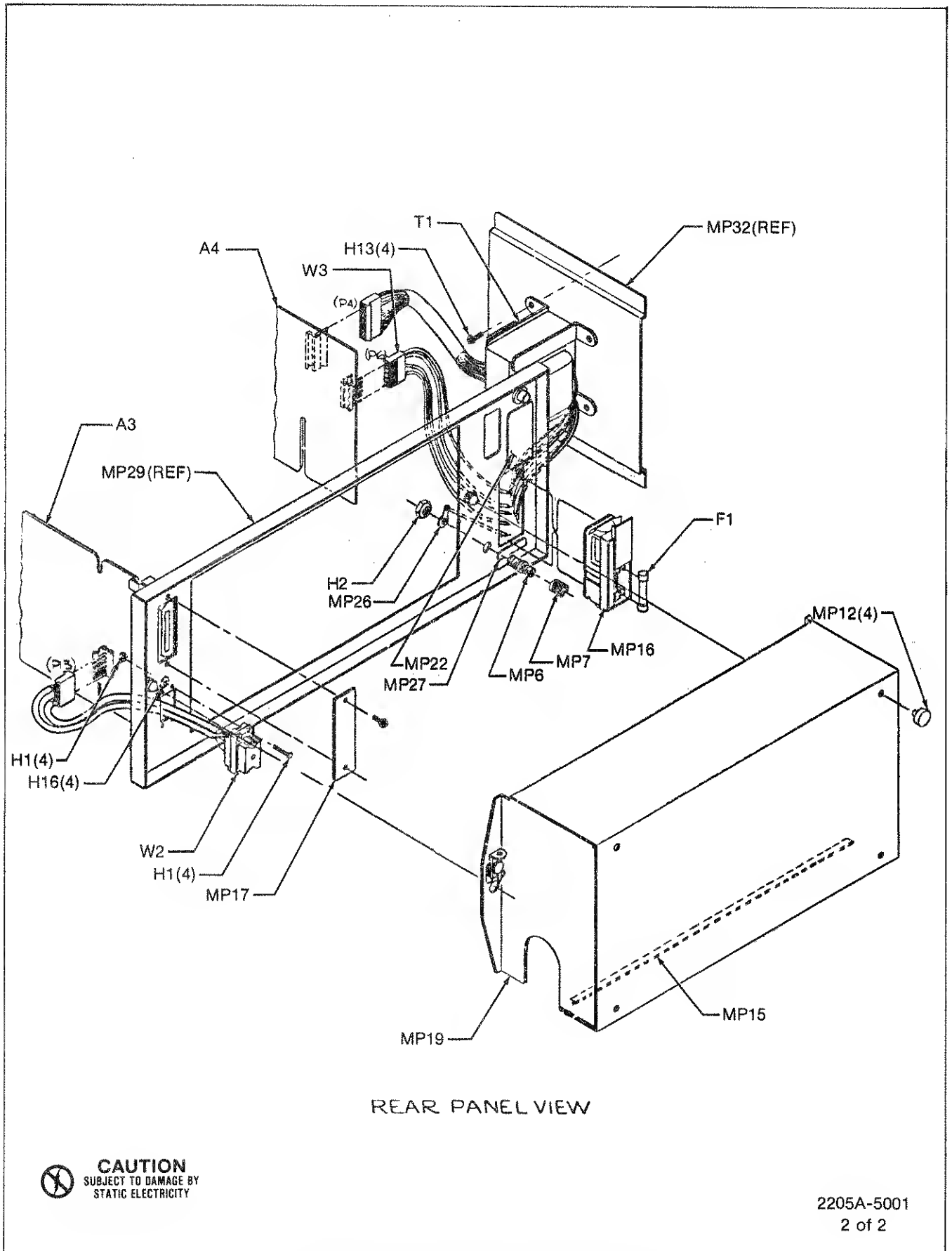


Figure 6-1. 6070A/6071A Final Assembly (cont)

Table 6-2. A1 Front Panel Display PCB Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | NOTE |
|------------|--|-----------------------|---------------------|-----------------|------------|------------|------|
| A1⑩ | FRONT PANEL DISPLAY PCB ASSY FIGURE 6-2 (2204A-4010T-PH2) | 639708 | 89536 | 611061 | REF | | |
| C1 | CAP, TA, 10 UF +/-20%, 20V | 330662 | 56289 | 196D106X0025KA1 | 4 | | |
| C2 | CAP, TA, 10 UF +/-20%, 20V | 330662 | 56289 | 196D106X0025KA1 | REF | | |
| C3 | CAP, TA, 10 UF +/-20%, 20V | 330662 | 56289 | 196D106X0025KA1 | REF | | |
| C4 | CAP, TA, 10 UF +/-20%, 20V | 330662 | 56289 | 196D106X0025KA1 | REF | | |
| C5 | CAP, MICA, 22 PF +/-5%, 500V | 148551 | 72136 | DM15C220J | 2 | | |
| C6 | CAP, MICA, 22 PF +/-5%, 500V | 148551 | 72136 | DM15C220J | REF | | |
| C7 | CAP, TA, 1 UF +/-20%, 35V | 161919 | 56289 | 196D105X0035JA1 | 1 | | |
| C8 | CAP, CER, 0.22 UF +/-20%, 50V | 309849 | 71590 | CW30C224K | 1 | | |
| CR1 | DIODE, SI, HI-SPEED SWITCH | 203323 | 07910 | 1N4448 | 5 | 1 | |
| CR2 | DIODE, SI, HI-SPEED SWITCH | 203323 | 07910 | 1N4448 | REF | | |
| CR3 | DIODE, SI, HI-SPEED SWITCH | 203323 | 07910 | 1N4448 | REF | | |
| CR4 | DIODE, INDICATOR, LED | 413831 | 29083 | MV5153 | 1 | 1 | |
| CR5 | DIODE, SI, HI-SPEED SWITCH | 203323 | 07910 | 1N4448 | REF | | |
| CR6 | DIODE, SI, HI-SPEED SWITCH | 203323 | 07910 | 1N4448 | REF | | |
| CR7 | DIODE, ZENER, 36V | 186163 | 07910 | 1N974B | 2 | 1 | |
| CR8 | DIODE, ZENER, 36V | 186163 | 07910 | 1N974B | REF | | |
| DS1 | DIODE, LED, 7-SEGMENT | 468124 | 89536 | 468124 | 3 | 1 | |
| DS2 | DIODE, LED, 7-SEGMENT | 468124 | 89536 | 468124 | REF | | |
| DS3 | DIODE, LED, 7-SEGMENT | 468124 | 89536 | 468124 | REF | | |
| MP1 | COVER, SWITCH | 401299 | 89536 | 401299 | 15 | | |
| MP2 | CONTACT, FIXED | 416875 | 00779 | 62313 | 15 | | |
| MP3 | SPRING | 414516 | 00779 | 63212 | 15 | | |
| MP4 | ACTUATOR, SWITCH | 412106 | 89536 | 412106 | 15 | | |
| MP5 | POST, CONNECTOR (TYPICAL) | 267500 | 00779 | 87022-1 | 30 | | |
| P7 | CONNECTOR, 6-PIN | 380378 | 89536 | 380378 | 2 | | |
| P9 | CONNECTOR, 6-PIN | 380378 | 89536 | 380378 | REF | | |
| P10 | CONNECTOR, FEMALE, 12-PIN | 447813 | 22526 | 65501-136 | 2 | | |
| Q1 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | 3 | 1 | |
| Q2 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q3 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q4 | XSTR, SI, NPN | 218396 | 04713 | 2N3904 | 1 | 1 | |
| R1 | RES, DEP. CAR, 390 +/-5%, 1/4W | 441543 | 80031 | CR251-4-5P390E | 2 | | |
| R2 | RES, DEP. CAR, 390 +/-5%, 1/4W | 441543 | 80031 | CR251-4-5P390E | REF | | |
| R3 | RES, DEP. CAR, 5.6K +/-5%, 1/4W | 442350 | 80031 | CR251-4-5P5K6 | 4 | | |
| R4 | RES, DEP. CAR, 5.6K +/-5%, 1/4W | 442350 | 80031 | CR251-4-5P5K6 | REF | | |
| R5 | RES, DEP. CAR, 5.6K +/-5%, 1/4W | 442350 | 80031 | CR251-4-5P5K6 | REF | | |
| R6 | RES, COMP, 4.7K +/-5%, 1/4W | 148072 | 01121 | CB4725 | 3 | | |
| R7 | RES, COMP, 4.7K +/-5%, 1/4W | 148072 | 01121 | CB4725 | REF | | |
| R8 | RES, COMP, 4.7K +/-5%, 1/4W | 148072 | 01121 | CB4725 | REF | | |
| R9 | RES, DEP. CAR, 2K +/-5%, 1/4W | 441469 | 80031 | CR251-4-5P2K | 1 | | |
| R10 | RES, DEP. CAR, 5.6K +/-5%, 1/4W | 442350 | 80031 | CR251-4-5P5K6 | REF | | |
| R11 | RES, DEP. CAR, 24 +/-5%, 1/4W | 442210 | 80031 | CR251-4-5P24E | 1 | | |
| R12 | RES, DEP. CAR, 10 +/-5%, 1/4W | 340075 | 80031 | CR251-4-5P10E | 1 | | |
| S1 | SWITCH, PIANO, 5 PST | 454769 | 00779 | 435802-4 | 1 | | |
| S2 | SWITCH, DIP, 4 PST | 408559 | 00779 | 435166-2 | 1 | | |
| S3 | SWITCH ASSY, PUSHBUTTONS PUSHBUTTON, BLUE (0) | 406736 | 89536 | 406736 | 1 | | |

Table 6-2. A1 Front Panel Display PCB Assembly (cont)

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | NO TE |
|------------|--|-----------------------|---------------------|--------------|------------|------------|----------|
| S3-2 | PUSHBUTTON, WHITE (1 THRU 9, 14) | 406744 | 89536 | 406744 | 10 | | |
| S3-3 | PUSHBUTTON, GREY (10 THRU 12) | 401307 | 89536 | 401307 | 3 | | |
| S3-4 | PUSHBUTTON, ORANGE (13) | 420620 | 89536 | 420620 | 1 | | |
| U1 | IC, 8-RESISTOR NETWORK, 180 | 424531 | 89536 | 424531 | 1 | 1 | |
| U2 | IC, TTL, BUFFERS, INTERFACE GATES | 407593 | 01295 | SN7406N | 2 | 1 | |
| U3 | IC, TTL, BUFFERS, INTERFACE GATES | 407593 | 01295 | SN7406N | REF | | |
| U4⊗ | IC, TTL, SCHOTTKY "D" TYPE, FLIP-FLOP | 454892 | 01295 | SN74LS273N | 1 | 1 | |
| U5⊗ | IC, TTL SCHOTTKY TRI-STATE, OCTAL BUFFER | 429902 | 12040 | DM81LS95N | 1 | 1 | |
| U7⊗ | ISOLATOR, OPT-CPLD, DUAL, HI-SPEED | 429894 | 28480 | 5082-4355 | 1 | 1 | |
| U8⊗ | IC, TTL, HEX INVERTER | 393058 | 01295 | SN74LS04N | 1 | 1 | |
| U9 | IC, TTL, QUAD, 2-INPUT, POS OR GATES | 393108 | 01295 | SN74LS32N | 1 | 1 | |
| U10 | IC, TTL SCHOTTKY DUAL "D" CLEAR & PRESET | 393124 | 01295 | SN74LS74N | 1 | 1 | |
| U11 | RES. NETWORK, 1K, DUAL IN LINE | 358119 | 89536 | 358119 | 1 | 1 | |
| XDS1 | SOCKET, IC, DIP, 14-PIN | 453514 | 23880 | T3800-14B | 3 | | |
| XDS2 | SOCKET, IC, DIP, 14-PIN | 453514 | 23880 | T3800-14B | REF | | |
| XDS3 | SOCKET, IC, DIP, 14-PIN | 453514 | 23880 | T3800-14B | REF | | |
| XU6 | SOCKET, IC, DIP, 40-PIN | 418988 | 91506 | 340-AG39D | 1 | | |
| XU7 | SOCKET, IC, DIP, 8-PIN | 478016 | 91506 | 308-AG39D | 1 | | |
| Y1 | CRYSTAL, 6 MHZ +/-0.015% | 461665 | 89536 | 461665 | 1 | 1 | |

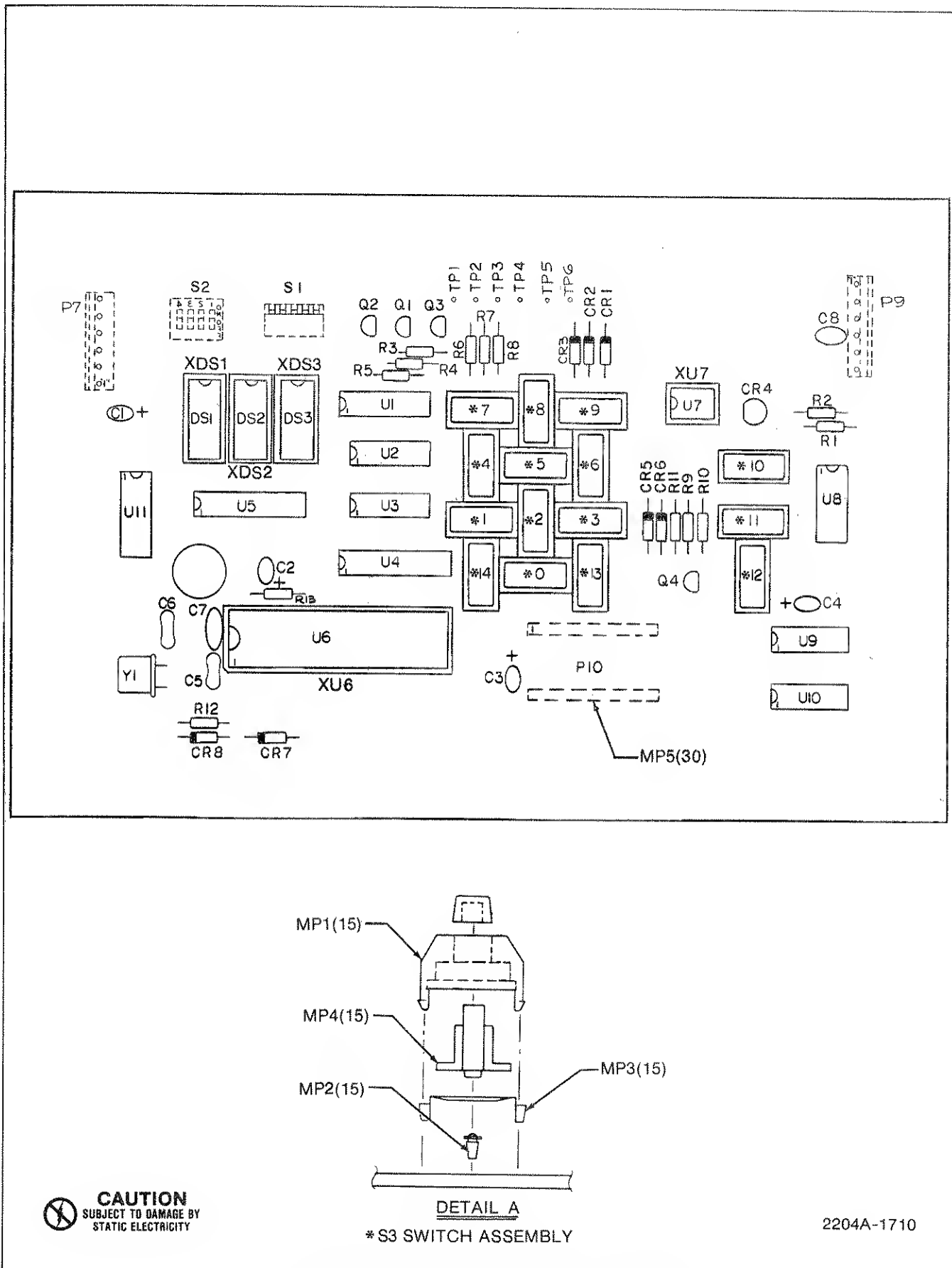


Figure 6-2. A1 Front Panel Display PCB Assembly

Table 6-3. A2 Mother Board PCB Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|---|-----------------------|---------------------|--------------|------------|------------|------------------|
| A2 | MOTHER BOARD PCB ASSY FIGURE 6-3 (2204A-4001T) | 468132 | 89536 | 468132 | REF | | |
| C1 | CAP, CER, 1000 PF +/-20%, 250VAC | 485680 | 52763 | RY11-2500 | 1 | | |
| J1 | CONNECTOR, CARD EDGE, 8-PIN | 354951 | 00779 | 583407-5 | 1 | | |
| J2 | CONNECTOR, CARD EDGE, 24-PIN | 295352 | 00779 | 583650-9 | 1 | | |
| J3 | CONNECTOR, 6-PIN | 291625 | 00779 | 583650-1 | 11 | | |
| J4 | CONNECTOR, 12-PIN | 291898 | 00779 | 583650-2 | 10 | | |
| MP1 | KEY, POLARIZING, CONNECTOR | 424572 | 89536 | 424572 | 33 | | |
| R1 | RES, COMP, 1.5M +/-5%, 1/2W | 108175 | 01121 | EB1555 | 1 | | |

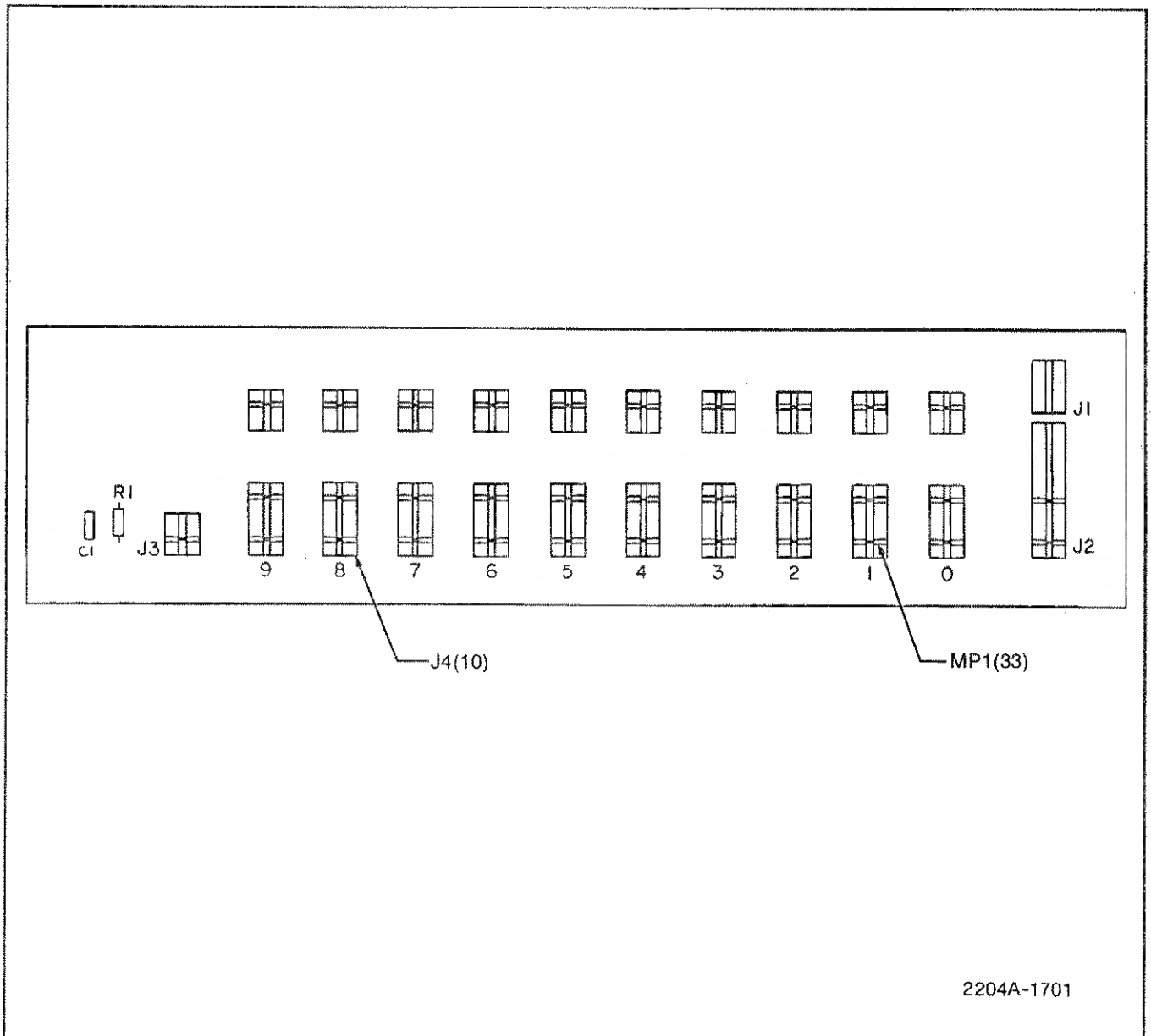
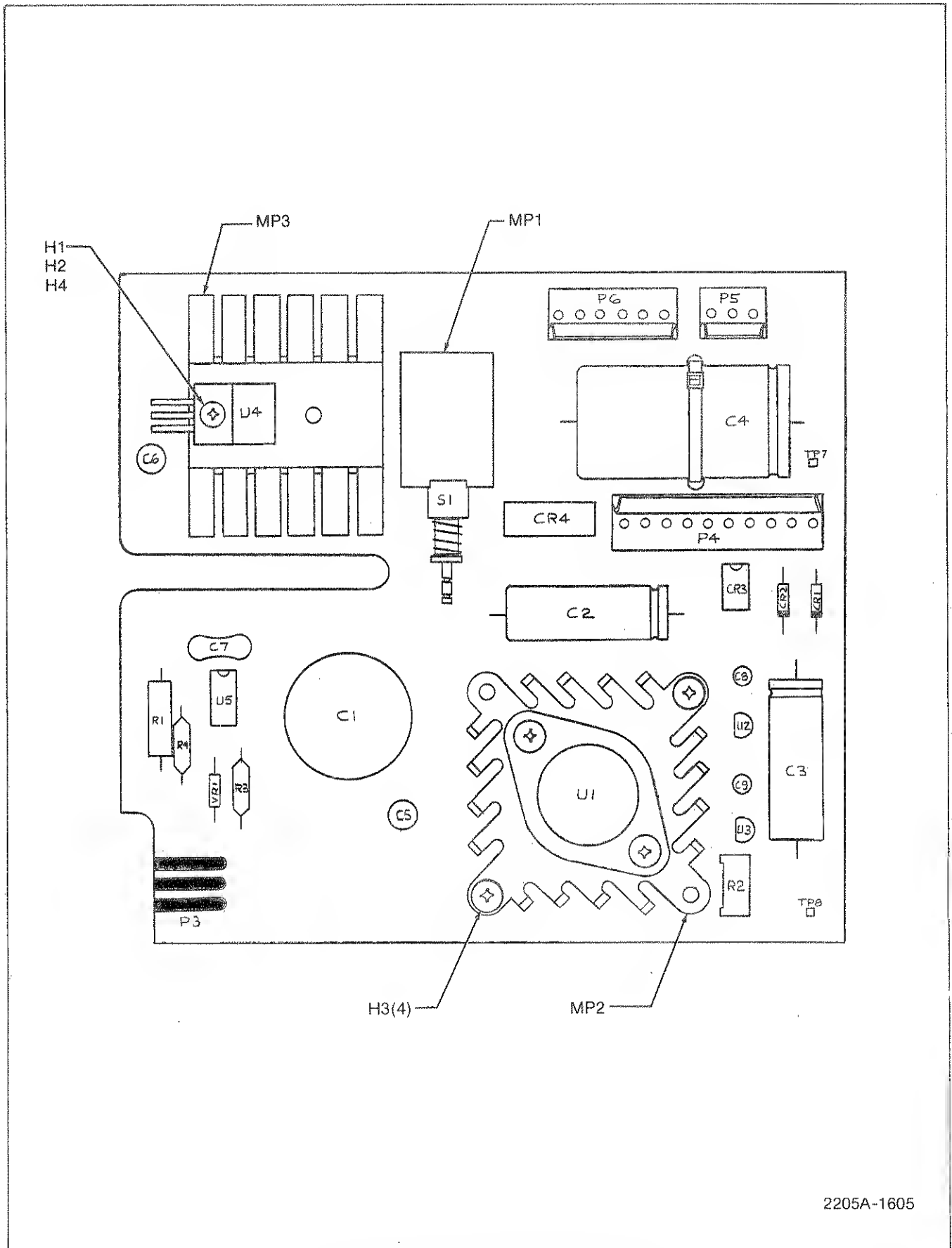


Figure 6-3. A2 Mother Board PCB Assembly

Table 6-4. A3 Power Supply PCB Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|---|-----------------------|---------------------|-----------------|------------|------------|------------------|
| A3 | POWER SUPPLY PCB ASSY FIGURE 6-4 (2205A-4005T) | 639690 | 89536 | 611897 | REF | | |
| C1 | CAP, ELECT, 10,000 UF -10/+30%, 16V | 603290 | 89536 | 603290 | 1 | | |
| C2 | CAP, ELECT, 220 UF -10/+50%, 40V | 178616 | 80031 | ET221X040A01 | 2 | | |
| C3 | CAP, ELECT, 220 UF -10/+50%, 40V | 178616 | 80031 | ET221X040A01 | REF | | |
| C4 | CAP, ELECT, 2200 UF -10/+100%, 25V | 392720 | 80031 | 3050HJ222U025 | 1 | | |
| C5 | CAP, ELECT, 15 UF +/-20%, 35V | 614024 | 89536 | 614024 | 2 | | |
| C6 | CAP, TA, 10 UF +/-20%, 20V | 330662 | 56289 | 196D106X0025KA1 | REF | | |
| C7 | CAP, MICA, 33 PF +/-5%, 500V | 160317 | 72136 | DM15E330J | 1 | | |
| C8 | CAP, TA, 1 UF +/-20%, 35V | 161919 | 56289 | 196D105X0035JA1 | 2 | | |
| C9 | CAP, TA, 1 UF +/-20%, 35V | 161919 | 56289 | 196D105X0035JA1 | REF | | |
| CR1 | DIODE, SI, PWR RECTIFIER | 483701 | 14099 | 5FF10 | 2 | 1 | |
| CR2 | DIODE, SI, PWR RECTIFIER | 483701 | 14099 | 5FF10 | REF | | |
| CR3 | RECTIFIER, BRIDGE, 1 AMP | 418582 | 83003 | VM08 | 1 | 1 | |
| CR4 | RECTIFIER, BRIDGE | 296509 | 09423 | FB200 | 1 | 1 | |
| H1 | NUT, HEX, 4-40 | 147611 | 89536 | 147611 | 1 | | |
| H2 | SCREW, PHP, 4-40 X 3/8 | 152124 | 89536 | 152124 | 1 | | |
| H3 | SCREW, PHP, 6-32 X 1/4 | 152140 | 89536 | 152140 | 4 | | |
| H4 | WASHER, LOCK, 4-40 | 110403 | 89536 | 110403 | 1 | | |
| MP1 | COVER, AC SWITCH | 475681 | 89536 | 475681 | 1 | | |
| MP2 | HEATSINK, w/U1 | 342675 | 89536 | 342675 | 1 | | |
| MP3 | HEATSINK, w/U4 | 473686 | 89536 | 473686 | 1 | | |
| MP4 | NYLON STRAP, w/C4 | 172080 | 89536 | 172080 | 1 | | |
| P4 | CONNECTOR, 10-PIN | 446724 | 27264 | 09-65-1101 | 1 | | |
| P5 | CONNECTOR, 3-PIN | 380022 | 89536 | 380022 | 1 | | |
| P6 | CONNECTOR, 6-PIN | 267500 | 00779 | 87022-1 | REF | | |
| R1 | RESISTOR, SELECTED SET | 377283 | 89536 | 377283 | 1 | | |
| R2 | RES, VAR, 500 +/-10%, 1/2W | 291120 | 89536 | 291120 | 1 | | |
| R3 | RESISTOR, SELECTED SET, SEE R1 | | | | | | |
| R4 | RES, MTL. FILM, 61.9K +/-1%, 1/8W | 237230 | 91637 | CMF556192F | 1 | | |
| S1 | SWITCH, PUSH-PUSH, DPDT | 453605 | 89536 | 453605 | 1 | | |
| U1 | IC, LIN, VOLTAGE REGULATOR, +5V DC | 453944 | 12040 | LM223K | 1 | 1 | |
| U2 | IC, LIN, VOLTAGE REGULATOR, +15V DC | 453035 | 04713 | MC78L15ACP | 1 | 1 | |
| U3 | IC, LIN, VOLTAGE REGULATOR, -15V DC | 454801 | 04713 | MC79L15ACP | 1 | 1 | |
| U4 | IC, LIN, VOLTAGE REGULATOR, +5V DC | 355107 | 12040 | F7805UC | 1 | 1 | |
| U5 | IC, LINEAR, OP AMP | 363515 | 12040 | LM301 | 1 | 1 | |
| VR1 | VOLTAGE REG, SELECTED SET, SEE R1 | | | | | | |



2205A-1605

Figure 6-4. A3 Power Supply PCB Assembly

Table 6-5. Extender Bus PCB Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|--|-----------------------|---------------------|-------------------|------------|------------|------------------|
| A4⊗ | EXTENDER BUS PCB ASSY FIGURE 6-5 (2204A-4015T-PH 2) | 639716 | 89536 | 611087 | REF | | |
| C1 | CAP, TA, 2.2 UF +/-20%, 20V | 161927 | 56289 | 196D225X0020HA1 | 6 | | |
| C2 | CAP, TA, 2.2 UF +/-20%, 20V | 161927 | 56289 | 196D225X0020HA1 | REF | | |
| C3 | CAP, TA, 2.2 UF +/-20%, 20V | 161927 | 56289 | 196D225X0020HA1 | REF | | |
| C4 | CAP, TA, 2.2 UF +/-20%, 20V | 161927 | 56289 | 196D225X0020HA1 | REF | | |
| C5 | CAP, TA, 2.2 UF +/-20%, 20V | 161927 | 56289 | 196D225X0020HA1 | REF | | |
| C6 | CAP, TA, 2.2 UF +/-20%, 20V | 161927 | 56289 | 196D225X0020HA1 | REF | | |
| CR1 | DIODE, SI | 203323 | 07910 | 1N4448 | 2 | 1 | |
| CR2 | DIODE, SI | 203323 | 07910 | 1N4448 | REF | | |
| H1 | SCREW, 4-40 X 3/8 | 152124 | 73734 | 19024 | 2 | | |
| H2 | WASHER, LOCK, #4 | 110395 | 89536 | 110395 | 2 | | |
| H3 | NUT, HEX, 4-40 | 147611 | 89536 | 147611 | 2 | | |
| H4 | LUG, SOLDER | 151431 | 79963 | 329 | 1 | | |
| H5 | KIT, CONNECTOR | 448563 | 89536 | 448563 | 1 | | |
| J12 | CONNECTOR, FEMALE, 36-PIN | 414409 | 00779 | 552241-1 | 1 | | |
| K1 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5*300BAA | 2 | | |
| K2 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5*300BAA | REF | | |
| P11 | PINS, CONNECTOR, MALE | 380378 | 89536 | 380378 | 2 | | |
| P13 | PINS, CONNECTOR, MALE | 380378 | 89536 | 380378 | REF | | |
| Q1 | XSTR, SI, NPN | 218396 | 04713 | 2N3904 | 2 | 1 | |
| Q2 | XSTR, SI, NPN | 218396 | 04713 | 2N3904 | REF | | |
| R1 | RES, DEP. CAR, 3.3K +/-5%, 1/4W | 348813 | 80031 | CR251-4-5P3K3 | 2 | | |
| R2 | RES, DEP. CAR, 3.3K +/-5%, 1/4W | 348813 | 80031 | CR251-4-5P3K3 | REF | | |
| R3 | RES, DEP. CAR, 2.2K +/-5%, 1/4W | 343400 | 80031 | CR251-4-5P2K2 | 2 | | |
| R4 | RES, DEP. CAR, 2.2K +/-5%, 1/4W | 343400 | 80031 | CR251-4-5P2K2 | REF | | |
| R5 | RES, DEP. CAR, 10K +/-5%, 1/4W | 348839 | 80031 | CR251-4-5P10K | 1 | | |
| S1 | SWITCH, SLIDE, SPDT | 453365 | 79727 | G1-116-0001G20-52 | 1 | | |
| U1⊗ | IC, MOS, HEX INVERTER | 381848 | 02735 | CD4049AE | 1 | 1 | |
| U2⊗ | IC, TTL, QUAD, D-TYPE FLIP-FLOP | 452912 | 12040 | MM74C175N | 3 | 1 | |
| U3⊗ | IC, TTL, QUAD, D-TYPE FLIP-FLOP | 452912 | 12040 | MM74C175N | REF | | |
| U4⊗ | IC, MOS, HEX BUFFER | 381830 | 02735 | CD4050AE | 4 | 1 | |
| U5⊗ | IC, MOS, QUAD, 2-INPUT AND GATE | 408401 | 02735 | CD4081AE | 1 | 1 | |
| U6⊗ | IC, MOS, DUAL 4-STAGE SHIFT REGISTER | 340125 | 04713 | MC14015BCP | 2 | 1 | |
| U7⊗ | IC, MOS, DUAL 4-STAGE SHIFT REGISTER | 340125 | 04713 | MC14015BCP | REF | | |
| U8⊗ | IC, MOS, HEX BUFFER | 381830 | 02735 | CD4050AE | REF | | |
| U9⊗ | IC, MOS, QUAD, AND/OR SELECT GATE | 419010 | 02735 | CD4019AE | 1 | 1 | |
| U10⊗ | IC, MOS, BCD-TO-DECIMAL DECODER | 473769 | 04713 | MC14028B | 1 | 1 | |
| U11⊗ | IC, MOS, QUAD, 2-INPUT OR GATE | 408393 | 02735 | CD4071BE | 1 | 1 | |
| U12⊗ | IC, TTL, QUAD, D-TYPE FLIP-FLOP | 452912 | 12040 | MM74C175N | REF | | |
| U13⊗ | IC, MOS, DUAL, 4-INPUT NOR GATE | 363820 | 02735 | CD4002AE | 1 | 1 | |
| U14⊗ | IC, MOS, HEX BUFFER | 381830 | 02735 | CD4050AE | REF | | |
| U15⊗ | IC, MOS, HEX BUFFER | 381830 | 02735 | CD4050AE | REF | | |

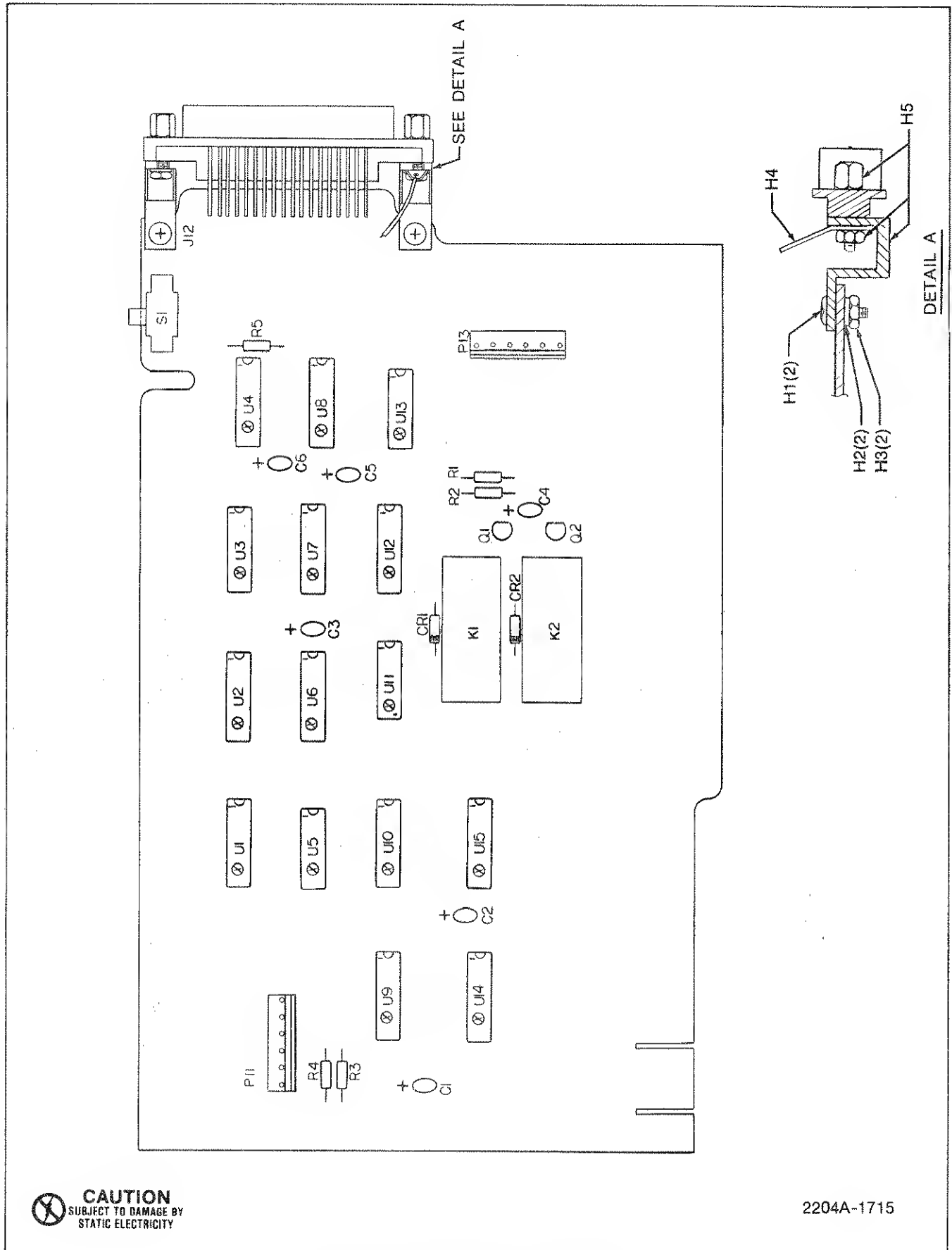


Figure 6-5. Extender Bus PCB Assembly

Section 7

Options and Accessories

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| OPTION/ MODEL NO. | DESCRIPTION | PAGE |
|----------------------|---|-------|
| 2205A-050 | IEEE-488 Interface | 050-1 |
| 2205A-060 | RS-232-C Interface | 060-1 |
| 2205A-100 | Actuator Module | 100-1 |
| 2205A-200 | Latching Module | 200-1 |
| 2205A-300 | General Purpose Scanner Module | 300-1 |
| 2205A-400 | Four-wire Resistance Scanner Module | 400-1 |
| 2205A-600 | Low Level Scanner Module | 600-1 |

7-1. INTRODUCTION

7-2. This section of the manual contains information concerning the options and accessories available for use with the Model 2205A Switch Controller. Each option and accessory is listed by model or option number in the table of contents on page 7-1.

7-3. Each option for the 2205A is documented as an individual subsection. All of the information necessary for installation, operation, and maintenance of the option is included in its own subsection. This includes a list of replaceable parts. Schematics are included in Section 9 of this manual.

7-4. Each subsection is uniquely identified by page and paragraph numbering that relates to that particular option. For example, a 600-X series identifies the subsection for the -600 option, where X is a sequential page or paragraph number.

7-5. ACCESSORIES

7-6. Introduction

7-7. Accessories include a series of rack mounting kits, remote interface cables/connectors, and scanner extender chassis. The rack mount kits are designed for use in standard 19-inch equipment racks. The cables/connectors are used for I/O connection between the 2205A and the extender chassis.

7-8. Rack Mounting Kit

7-9. The 2205A can be rack mounted in a standard 19-inch equipment rack using Rack Mounting Kit, M07-205-600. Use the following procedure to install the kit:

1. Peel off the nameplate decals from the front side-corners of the unit.
2. Remove the front corner screws which match the hole pattern in the rack mounting ears (see Figure 7-1).
3. Attach the rack mounting ears to the front corners of the unit using the screws supplied in the rack mounting kit.

7-10. Rack Slide Kit

7-11. The 2205A can be rack mounted in a 24-inch deep equipment rack using the Rack Slide Kit, M00-280-610. Use the following procedure to install the kit:

1. Remove the horizontal side trim decal from both sides of the unit.
2. Refer to Figure 7-2, and, using the screws supplied with the kit, attach the Chassis Section (B) of the slide kit to each side of the unit. Use the center row of mounting holes.

3. Install the Cabinet Section (D) and the Center Section (C) in the equipment rack.
4. Pull the Center Section of the slide out through the front of the equipment rack until it locks in the extended position.
5. Depress the spring locks on the Chassis Section (B) and join Section B and C.
6. Push the unit into the equipment rack and then pull it out to the extended position. The spring locks should limit the rack slide travel.

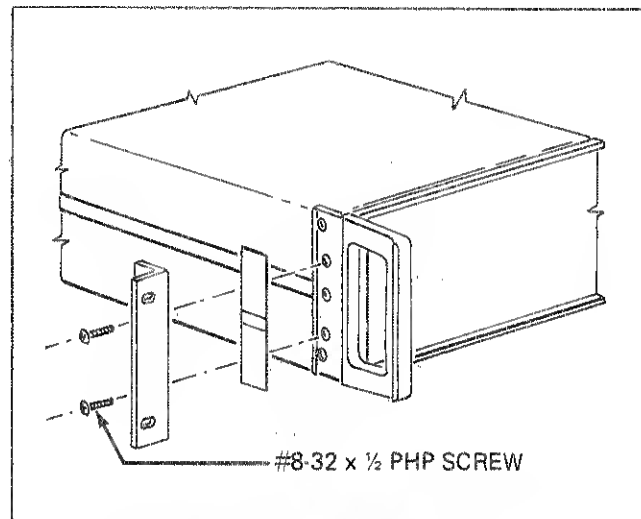


Figure 7-1. Rack Mounting Kit

7-12. Remote Scanner Cables

7-13. The cable assemblies necessary to add a series of extender chassis are fabricated by the factory on a custom basis. This allows the user to determine the cable lengths necessary for a particular application. The components required to complete a cable are available as two kits; a connector kit 2200A-7001 (two connector assemblies), and a length of cable 2200A-7002. When ordering the cable specify the length in feet. An assembled cable is shown in Figure 7-3.

7-14. IEEE-488 Compatible Interface Cables

7-15. A series of three interface cables are available for use with the IEEE-488 Compatible Interface (Option -050). The cables are available in 1, 2, and 4 meter lengths. (Y8001, Y8002, and Y8003 respectively). As shown in Figure 7-3, the cables are equipped with double-ended connectors so that they may be interconnected in serial and/or star patterns.

7-16. RS-232 Interface Cable

7-17. A 3-meter interface cable is available for use with the RS-232-C Interface (Option -060). Specify Model Y8004 when ordering.

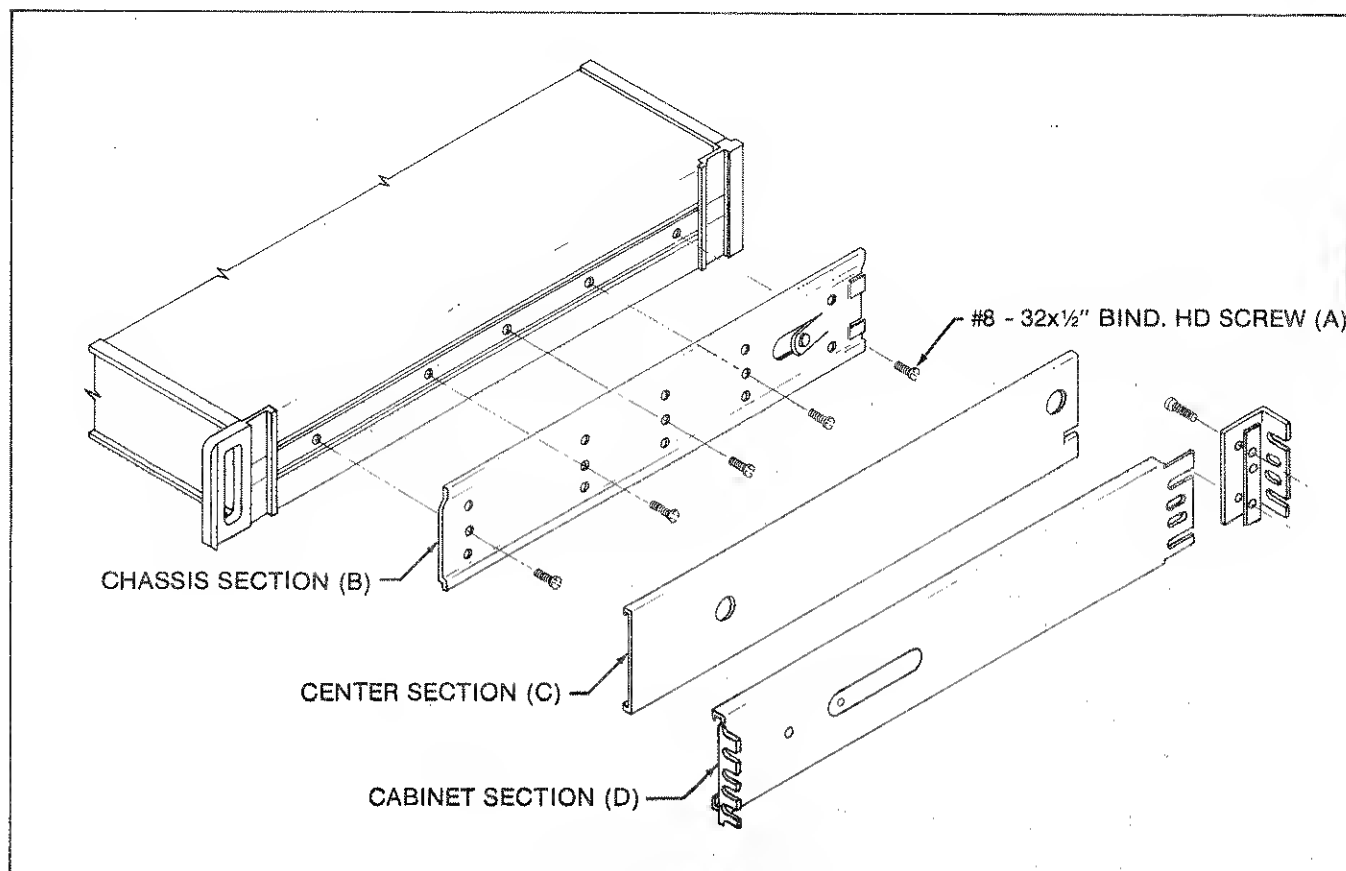


Figure 7-2. Rack Slide Kit

7-18. Analog Signal Cable

7-19. A 1-meter analog signal cable (Figure 7-3) connects the 2205A to a DMM. Specify the Model Y8076 Analog Signal Cable (one cable is included with the 2205A) when ordering.

7-20. Delay Trigger Cable

7-21. A 0.9 meter coax cable (see Figure 7-3) with male BNC connectors is available for use as a 2205A delay trigger cable to trigger a DMM reading. Specify Model Y8013 when ordering.

7-22. Extender Chassis

7-23. The channel capacity of the 2205A can be expanded from 100 up to 1000 by adding a series of extender chassis. Two units are available for this purpose; the Model 2201A (120 channels) and the Model 2202A (100 channels). Both units function as a physical extension of the 2205A logic. The Model 2201A is recommended for applications not more than 50 feet away from the 2205A. Locations from 51 to 1500 feet from the 2205A should use the 2202A.

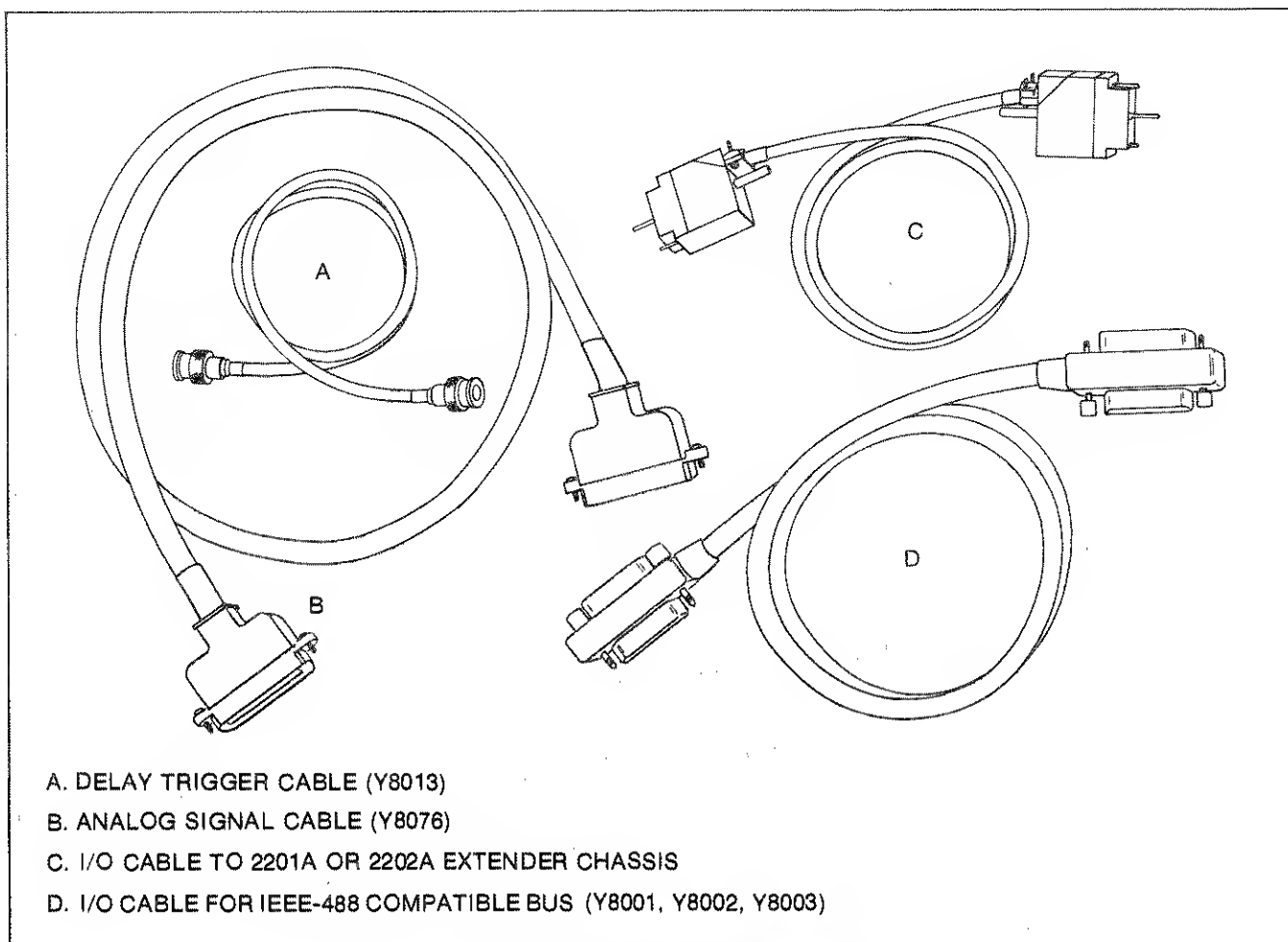


Figure 7-3. Rear Panel Cables

Option 2205A-050
IEEE-488 Compatible Interface

050-1. INTRODUCTION

050-2. The IEEE-488 Compatible Interface (Option -050) provides the controller mainframe with a remote control interface capable of responding to the asynchronous transfer of character-serial ASCII control data by way of an IEEE-488, 1978 Standard bus. This bus is bidirectional and can be driven by a variety of program sources, such as, a computer or a system controller. Since the controller mainframe responds to (listens), but does not issue control data (talk), it is defined as a listen-only device. A unique address code (0 through 30) is assigned (by the user) to the interface so that all control data on the

bus is ignored by the controller mainframe unless it is preceded by the proper listen address. A series of handshake lines ensure the asynchronous transfer of data regardless of data speed.

050-3. Connection of the controller mainframe to the system data bus is made with a 24-pin connector that conforms to the IEEE-488 standard.

050-4. SPECIFICATIONS

050-5. The specifications for the IEEE-488 Compatible Interface are listed in Table 050-1.

Table 050-1. Option -050 Specifications

| | | | |
|-----------------|--|--------------------|---------------------|
| Functions | This option provides the following functions of the IEEE-488, 1978 Standard Compatible Bus. | | |
| | SUBSET | FUNCTION | REMARKS |
| | SH0 | Source Handshake | No Capability |
| | AH1 | Acceptor Handshake | Complete Capability |
| | T0 | Talker | No Capability |
| | TE0 | Extended Talker | No Capability |
| | L2 | Listener | Listen Only |
| | LE | Extended Listener | |
| | SRO | Service Request | No Capability |
| | RL1 | Remote Local | Complete Capability |
| | PP0 | Parallel Poll | No Capability |
| | DC1 | Device Clear | Complete Capability |
| | DT0 | Device Trigger | |
| | C0 | Controller | No Capability |
| Messages | The -050 will handshake all messages on the bus. However only those listed above will affect the instrument's operation. | | |
| Address | Any address from 0 to 30 may be user selected. Factory installed option has address set at 3. Instrument shows address at power up as 'Axx'. | | |

050-6. INSTALLATION

050-7. A controller mainframe can be equipped with either an IEEE-488 Compatible Interface (Option -050) or an RS-232-C Interface (Option -060). If an IEEE-488 Compatible Interface is to be installed, it may or may not replace an existing interface pcb. The IEEE-488 Compatible Interface PCB installs as follows:

1. Remove the 2205A from line power.
2. Remove the top cover.
3. Remove the three screws along the top side of the Front Panel Display PCB.
4. Push the pcb away from the front panel (the switch buttons must clear the front panel) and pull the pcb upward.
5. Unplug the attached cables.
6. Remove the four screws that hold the existing interface pcb to the Front Panel Display PCB.
7. Carefully separate the two pcbs at connectors J10 and P10.
8. Remove the rear panel screws that anchor the interface connector to the rear panel.
9. Plug the IEEE-488 Interface PCB into the Front Panel Display PCB at J10 and P10.
10. Thread the interface cable along side of the guard housing so that the cable won't interfere with the installation of the top cover.
11. Position the 24-pin connector in the REMOTE INTERFACE hole in the rear panel and anchor it in place using the screws removed earlier.
12. Set switch S1 on the Front Panel Display PCB for the desired IEEE-488 address. See Section 2 of this manual for the instructions necessary to select an address.
13. Install the Front Panel Display PCB and the top dust cover.

050-8. INTERFACE INFORMATION

050-9. System Connection

050-10. Connection of the controller mainframe to the IEEE-488 compatible system bus is made using a 24-wire cable. The cable is available as an accessory and comes in three standard lengths; 1, 2, and 4 meters. See the Accessories section for cable descriptions and model numbers.

050-2

050-11. Cables may be interconnected in any manner deemed suitable by the user; i.e., star, linear or combinations thereof. Before a cable is ordered, the system bus should be analyzed to ensure that adding the controller mainframe will not cause an excessive load. IEEE-488 compatible system connections must not exceed the following limits:

1. No more than 15 bus loads may be connected in a single IEEE-488 compatible system bus.
2. The total length of cable used in one IEEE-488 compatible system bus must not exceed 20 meters.
3. The length of cable must also not exceed 2 meters times the number of devices in the system.

050-12. Each cable added to the IEEE-488 compatible bus connects all 26 lines of the added interface in parallel with all other devices on the bus. As a result, the cable not only connects the added device, it also physically and electrically extends the bus. Sixteen of the lines are signal lines. The remaining lines are used for signal support, i.e., logic common, signal return and shield. The 16 signal lines are separated into 8 data lines, the data byte transfer (handshake) lines and 5 general interface management lines. The data lines normally carry ASCII control characters and data. Data transfer is asynchronous and is directly controlled by the handshake lines. Thus, data transfer speed varies to accommodate the speed of the sending and receiving devices. Cable pin assignments and signal definitions are given in Table 050-2.

050-13. Basic Listener

050-14. All devices connected to the IEEE-488 compatible bus can be functionally categorized as controllers, talkers, and listeners. The 2205A qualifies as a listener. A brief description of each function follows:

1. Controller
A controller is a device that assigns which device will transmit data (talk) and which device(s) will receive data (listen). There may be only one controller. It services all interrupts. A controller may be a listener or talker.
2. Talker
A talker is a device that outputs data to the bus on command. Only one talker can be assigned (addressed) at any one time.
3. Listener
A listener is a device that, when properly addressed, accepts data from the bus. Up to 14 listeners can participate in any simultaneous bus operation.

Table 050-2. IEEE-488 Compatible Interface Pin Assignments

| PIN | MNEMONIC | FUNCTION | COMMENTS |
|-----|----------|---|---|
| 1 | DIO1 | DATA | Data input/output lines. Message bytes are carried on the DIO lines in a bit-parallel byte-serial form, asynchronous, and generally in a bidirectional manner. |
| 2 | DIO2 | DATA | |
| 3 | DIO3 | DATA | |
| 4 | DIO4 | DATA | |
| 13 | DIO5 | DATA | |
| 14 | DIO6 | DATA | |
| 15 | DIO7 | DATA | |
| 16 | DIO8 | DATA | |
| 5 | EOI | End of Identify | Used to indicate the end of a multiple byte message. |
| 6 | DAV | Data Available | Is asserted TRUE by the sender of data when NRFD goes TRUE, remains TRUE until NDAC is sent TRUE by the data receiver. |
| 7 | NRFD | Not Ready For Data | When all devices are ready to receive data this line goes high. Remains high until DAV is sent TRUE. |
| 8 | NDAC | No Data Accepted | When all receiving devices are through with the data on the bus, this line goes high, indicating that the sender may remove the data and set DAV low. When DAV goes to the receiving devicea then pull NDAC low again. |
| 9 | IFC | Interface Clear | Sent high by the controller. It places all device interfaces in a known quiescent atate. |
| 10 | SRQ | Service Request | This line is used by some devicea to get the attention of the controller. |
| 11 | ATN | Attention | Used by the controller to notify all other devices what type of message (interface versus device dependent) is on the data bus. When ATN is TRUE, messages sent are interface messages and all devices capable of receiving messages must handshake the transfer. When false, device dependent messages are sent and only devices that have been addressed remain active. |
| 12 | | Shield* | Surrounds all conductors. |
| 17 | REN | Remote Enable | Must be TRUE to place instruments into remote. Once in Remote, if REN goes false all instruments must go to local. |
| 18 | GND | Return to DAV | |
| 19 | GND | Return to NRFD | |
| 20 | GND | Return to NDAC | |
| 21 | GND | Return to IFC | |
| 22 | GND | Return to SRQ | |
| 23 | GND | Return to ATN | |
| 24 | GND | Logic common for DIO1-DIO8, EOI and REN | |

*The cable shield is internally routed to a banana jack on the rear of the 2205A adjacent to the line connector.

050-15. Interface Address

050-16. Any address from 0 through 30 may be assigned to the controller mainframe. The address is determined by the position of the sections of switch S1 on the Front Panel Display PCB. The selected address is displayed when the controller mainframe is turned on. Instructions for setting the switch are given in Section 2 of this manual.

050-17. Interface Messages

050-18. The interface handshakes all messages on the bus. The interface messages for the IEEE-488 Compatible Interface are listed in Table 050-3.

050-19. OPERATION

050-20. Once installed, the IEEE-488 Interface does not require attention from the operator. Programming information is given in Section 3 of this manual.

050-21. THEORY OF OPERATION

050-22. The IEEE-488 Interface, as shown in Figure 050-1, consists of a series of four, 4-bit data buffers and an 8-bit tri-state inverter. Two of the inverters receive ASCII character-serial data (DIO1-DIO8) and present it to the input of the tri-state inverter. The inverter is normally in the high impedance state. When the microcomputer is ready to read input data, it issues a Port 0 Enable and a

read (RD) command. This enables the tri-state buffer causing the 8-bit character to be placed onto the microcomputer's data bus. The IEEE-488 handshake lines (three) and general interface management lines (five) control input/output to and from the microcomputer through the data buffers. Buffered input lines includes: REN, DAV, ATN, and IFC. Buffered output lines include: RFD, DAC, EOI, and SRQ. All handshake and management routines are handled by the microcomputer.

050-23. MAINTENANCE

050-24. Calibration and/or adjustment of the IEEE-488 Interface PCB is not required. The performance of the interface can be checked using the Remote Test Procedure given in Section 5 of this manual.

050-25. LIST OF REPLACEABLE PARTS

050-26. A list of replaceable parts for the IEEE-488 Compatible Interface is given in Table 050-4. Refer to Section 6 of this manual for ordering information.

CAUTION

Indicated devices are subject to damage by static discharge.

Table 050-3. Interface Messages

| MESSAGE | MNEMONICS | MESSAGE CODING | NOTES |
|-----------------------|-----------|----------------|---------|
| My Listen Address | MLA | 00 through IE | 2, 3, 4 |
| Unlisten | UNL | 3F | 1 |
| Local Lockout | LLO | 11 | 1, 3 |
| Go To Local | GTL | 01 | 3 |
| Device Clear | DCL | 14 | 1 |
| Selected Device Clear | SDC | 04 | 2 |

1 = Universal Command

2 = Address Command

3 = Messages that affect the interface while in local

4 = Receiving MLA will address the interface or a listener and place the interface (and 2205A) into remote if REN is sent true.

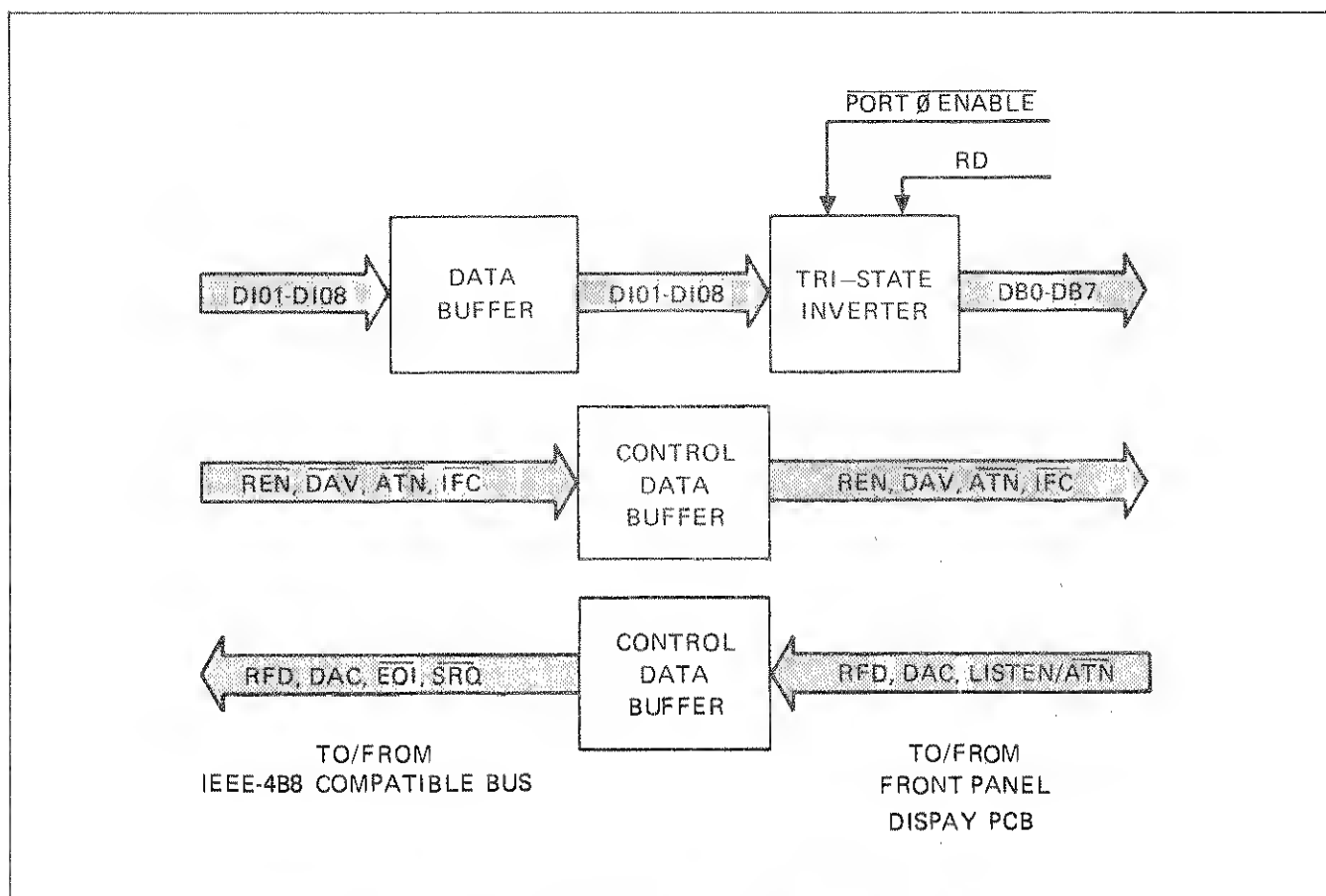
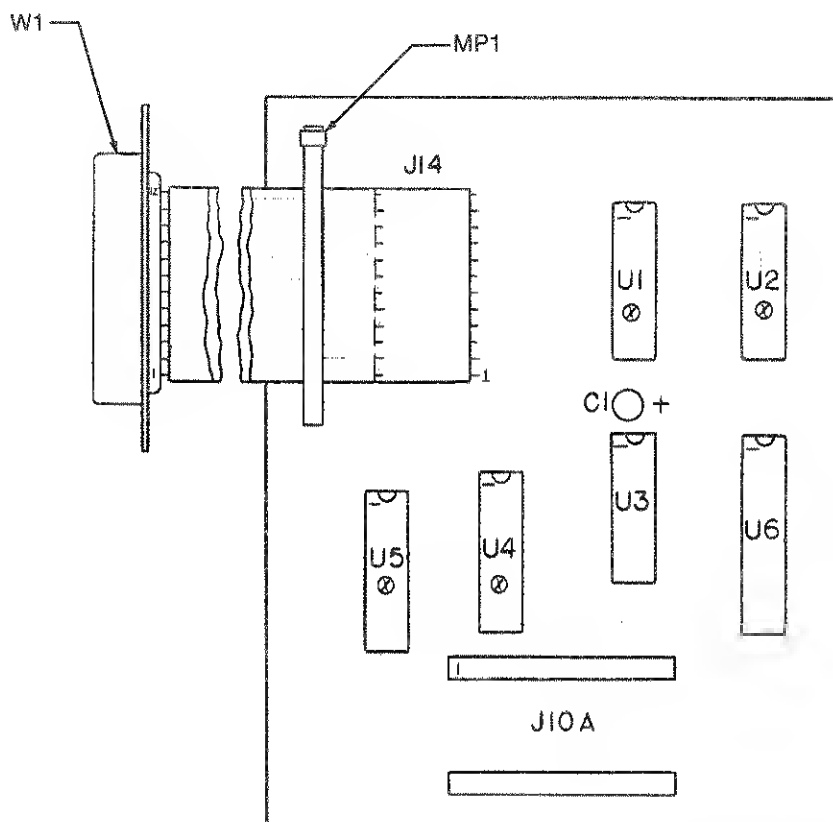


Figure 050-1. IEEE-488 Compatible Interface Block Diagram

Table 050 -4. IEEE-488 Interface PCB Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | NOTE |
|------------|---|-----------------------|---------------------|-----------------|------------|------------|------|
| -050② | IEEE-488 INTERFACE PCB ASSY FIGURE 050-2 (2204A-4012T) | 639765 | 89536 | 469254 | 1 | | |
| C1 | CAP, TA, 10 UF +/-20%, 20V | 330662 | 56289 | 196D106X0025KA1 | 1 | | |
| J10A | CONNECTOR, FEMALE, 12-PIN | 417733 | 30035 | SS-109-1-12 | 2 | | |
| MP1 | STRAP, NYLON | 172080 | 06383 | SST-1M | 1 | | |
| U1② | IC, MOS, QUAD, INTERFACE BUS TRANSCEIVER | 428649 | 04713 | MC3446P | 4 | 1 | |
| U2② | IC, MOS, QUAD, INTERFACE BUS TRANSCEIVER | 428649 | 04713 | MC3446P | REF | | |
| U3 | IC, TTL, QUAD, 2-INPUT, NOR GATE | 393041 | 01295 | SN74LS02N | 1 | 1 | |
| U4② | IC, MOS, QUAD, INTERFACE BUS TRANSCEIVER | 428649 | 04713 | MC3446P | REF | | |
| U5② | IC, MOS, QUAD, INTERFACE BUS TRANSCEIVER | 428649 | 04713 | MC3446P | REF | | |
| U6 | IC, SCHOTTKY | 453308 | 12040 | DM81LS96N | 1 | 1 | |
| W1 | CABLE ASSEMBLY, IEEE 488 | 468629 | 89536 | 468629 | 1 | | |



CAUTION
SUBJECT TO DAMAGE BY
STATIC ELECTRICITY

2204A-1712

Figure 050-2. IEEE-488 Interface PCB Assembly

Option 2205-060 RS-232-C Interface

060-1. GENERAL

060-2. EIA Standard RS-232-C provides the electronics industry with the ground rules necessary for independent manufacturers to design and produce both data terminal and data communication equipment that conforms to a common interface requirement. As a result, a data communications system can be formed by connecting an RS-232-C data terminal (such as, a controller mainframe) to an RS-232-C data communication peripheral (such as, a TTY, MODEM, computer, etc.). This works fine on paper. However, in practice, the user must be aware of the subtleties of serial binary data interchange to ensure that any two pieces of RS-232-C equipment will be compatible. For example, the two instruments must share at least one of the features from each of the following characteristics:

1. Timing Format - Synchronous or Asynchronous.
2. Transmission Mode - Simplex, half-duplex or full duplex.
3. Baud Rate (bits per second) - 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600.
4. Bits per character - 5, 6, 7, 8.
5. Parity Bit - Odd, even, hi, low, not used.
6. Data Interface Levels - EIA or 20 mA current loop.

060-3. Timing formats conforming to both synchronous and asynchronous operation are shown in Figure 060-1. In asynchronous operation each character is bracketed by both start and stop bits. These bits separate the characters and synchronize both the transmission and receipt of data. When data is not being sent the data line is held high. In synchronous operation a

sync character is sent prior to each data stream (a data stream usually consists of a block of characters). When the line is idle a fill or sync character is continuously transmitted.

060-4. Transmission mode is an overall system requirement. It defines the communication ability of both instruments in the system configuration. Simplex indicates data transmission in one direction only. Half-duplex permits two way communication, but not simultaneously. Simultaneous transmission of data in both directions defines a full duplex system. Obviously, an instrument capable of full-duplex operation can be down graded to simplex operation. However, the reverse is not possible without degrading the system capability.

060-5. Baud rate is usually selectable on a RS-232-C Interface. If it is not, the manufacturer usually offers a choice when the instrument is purchased.

060-6. Character format (bits per character and parity) is somewhat flexible between instruments. Investigate the requirements of both instruments before committing either to a system configuration.

060-7. Data interface levels can occur as either EIA voltage levels or as a 20 mA current loop. At times an interface offers both simultaneously. The 20 mA current loop is used almost exclusively for teletypewriter, or paper tape punch/reader interface. EIA voltage levels are: 1 or OFF = -15 to -3V dc, 0 or ON = +3 to +15V dc.

060-8. INTRODUCTION

060-9. The RS-232-C Interface (Option 2205A-060) is designed to interface the controller mainframe with an external RS-232-C data communication instrument, such as a TTY, modem, computer, CRT, etc. It features asynchronous timing, simplex operation, selectable baud rate, and EIA voltage levels. The interface is not addressable and, therefore, responds to all input data.

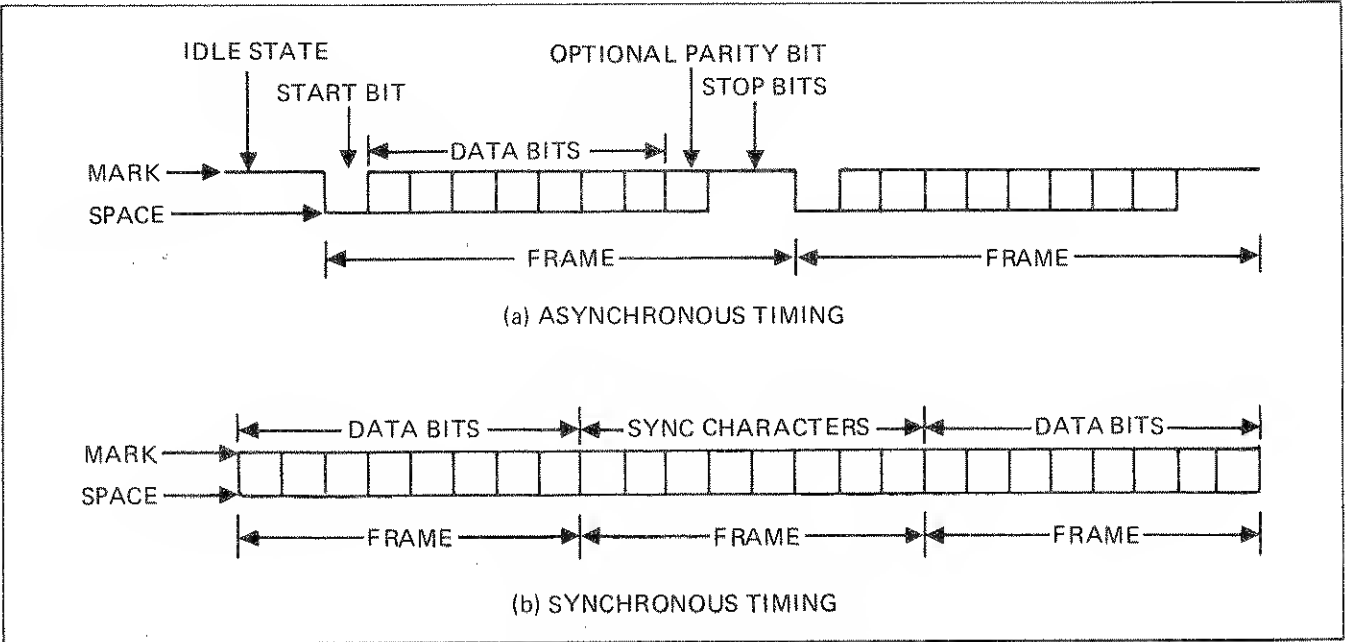


Figure 060-1. RS-232-C Timing Formats

060-10. Interface connection to the remote data communication instrument is made by way of a rear-panel, 25-pin connector labeled REMOTE INTERFACE. The connector is RS-232-C compatible. A mating connector is supplied with the option for use in fabricating an interface cable.

060-11. SPECIFICATIONS

060-12. Specifications for the RS-232-C Interface Option are listed in Table 060-1.

060-13. INSTALLATION

060-14. A controller mainframe can be equipped with either an IEEE-488 (Option -050) or an RS-232-C (Option -060) Interface PCB. If an RS-232-C interface is to be installed, it may or may not replace an existing interface pcb. The RS-232-C Interface PCB installs as follows:

1. Remove the 2205A from line power.

2. Remove the top cover.
3. Remove the three screws along the top side of the Front Panel Display PCB.
4. Push the pcb away from the front panel (the switch buttons must clear the front panel) and pull the pcb upward.
5. Unplug the attached cables.
6. Remove the four screws that hold the existing interface pcb to the Front Panel Display PCB.
7. Carefully separate the two pcbs at connectors J10 and P10.
8. Remove the rear panel screws that anchor the interface connector to the rear panel.

Table 060-1. Option -060 Specifications

| | |
|-------------------|---|
| Timing Format | Asynchronous |
| Input Data Format | Bit-Serial, Seven Level ASCII with two stop bits |
| Baud Rates | 110; 134.5, 150, 300, 600, 1200, 2400, 4800 (switch selectable) |
| Parity | Not used |
| Signal Levels | EIA voltage level inputs |

9. Plug the RS-232-C Interface PCB into the Front Panel Display PCB at J10 and P10.

10. Thread the interface cable along side of the guard housing so that the cable won't interfere with the installation of the top cover.

11. Position the 25-pin connector in the REMOTE INTERFACE hole in the rear panel and anchor it in place using the screws removed earlier.

12. Set switch S1 on the Front Panel Display PCB for the desired baud rate. See Section 2 of this manual for the instructions necessary to select baud rate.

13. Install the Front Panel Display PCB and the top dust cover.

060-15. INTERFACE INFORMATION

060-16. The input connection to the RS-232-C Interface is made using a 25-pin female connector, type DB25S. The connector is available from Fluke as P/N 312579. A compatible hood is also available as P/N 320184. Connections necessary to complete an interface cable are limited to pins 3 and 7. Pin 3 is Transmitted Data and pin 7 is Signal Ground. Use a twisted pair to form the cable between the bit-serial data source and the interface connector.

060-17. OPERATION

060-18. Once installed, the RS-232-C Interface does not require attention from the operator. Programming information is given in Section 3 of this manual.

060-19. THEORY OF OPERATION

060-20. The RS-232-C Interface is designed to enable a 2205A to be controlled by a remote bit-serial data source such as a computer, CRT, TTY, etc. Input data requirements include EIA voltage levels, 8-bit ASCII control characters, and two stop bits. Data is received in the asynchronous mode, and baud rates from 100 through 4800 are switch selectable. Parity (the eighth bit of each character) is not checked and therefore may be odd, even, high, or low.

060-21. The RS-232-C Interface, as shown in Figure 060-2, consists of a universal asynchronous receiver transmitter (UART), an EIA line receiver, and a programmable bit-rate generator. The UART receives TTL, character-serial data via the EIA line receiver and enters it into memory in synchronous with the baud rate clock. When a complete character is stored, the UART issues a Data Ready pulse to the microcomputer which, in turn, issues read and port 0 enable commands. These commands cause the UART to place the stored ASCII character onto the Data Bus so that it can be read by the microcomputer.

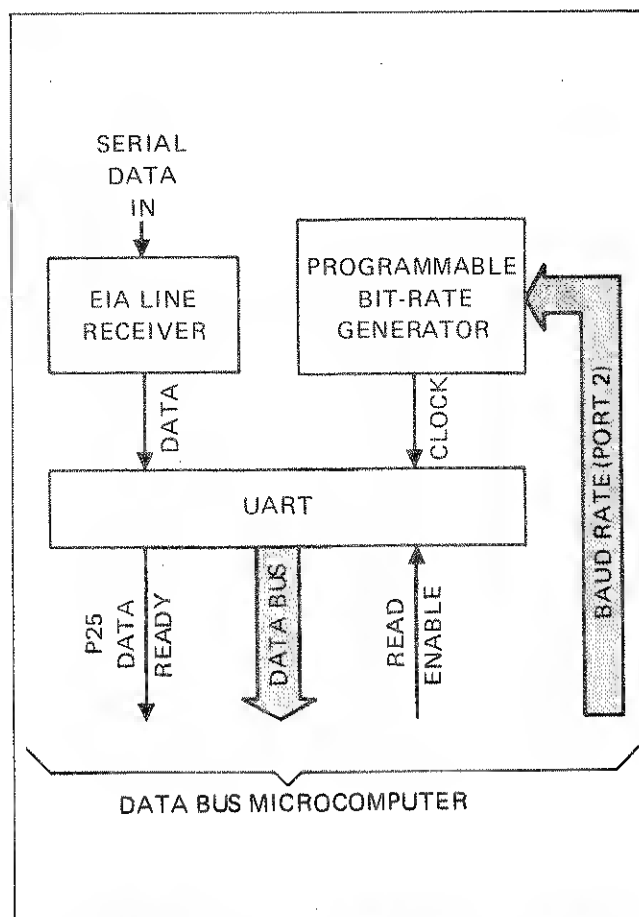


Figure 060-2. RS-232-C Interface Block Diagram

060-22. The bit-serial data rate is controlled by an onboard, programmable bit-rate generator which runs continuously at 16 times the programmed baud rate. This increased frequency is necessary to satisfy the UART which must synchronize incoming data. Program data for the bit-rate generator is received from the microcomputer which, in turn, receives baud-rate information from the baud rate switch on the Front Panel Display PCB.

060-23. MAINTENANCE

060-24. Calibration and/or adjustment of the RS-232-C Interface PCB is not required. The performance of the interface can be checked using the Remote Test Procedure given in Section 5 of this manual.

060-25. LIST OF REPLACEABLE PARTS

060-26. A list of replaceable parts for the RS-232-C Interface is given in Table 060-2. Refer to Section 6 of this manual for ordering information.

CAUTION



Indicated devices are subject to damage by static discharge.

Table 060-2. RS-232C Interface PCB Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | NOTE |
|------------|---|-----------------------|---------------------|-----------------|------------|------------|------|
| -060② | RS-232-C INTERFACE PCB ASSEMBLY FIGURE 060-3 (2204A-4011T) | 639757 | 89536 | 469247 | 1 | | |
| C1 | CAP, TA, 10 UF +/-20%, 20V | 193623 | 56289 | 196D106X0020KA1 | 1 | | |
| C2 | CAP, MICA, 56 PF +/-5%, 500V | 148528 | 72136 | DM15F560J | 2 | | |
| C3 | CAP, MICA, 56 PF +/-5%, 500V | 148528 | 72136 | DM15F560J | REF | | |
| J10B | CONNECTOR, FEMALE, 12-PIN | 417733 | 30035 | SS-109-1-12 | 2 | | |
| MP1 | STRAP, NYLON | 172080 | 06383 | SST-1M | 2 | | |
| R1 | RES, COMP, 10M +/-5%, 1/4W | 194944 | 01121 | CB1065 | 1 | | |
| R2 | RES, DEP. CAR, 1K +/-5%, 1/4W | 343426 | 80031 | CR251-4-5P1K | 1 | | |
| U1② | IC, C-MOS, RECEIVER, TRANSMITTER | 453464 | 32293 | 1M6402CPL | 1 | 1 | |
| U2 | IC, TTL, MSI, DUAL COMMUNICATIONS | 354704 | 18324 | 8T16A | 1 | 1 | |
| U3② | IC, C-MOS, PROGRAMABLE, BIT RATE GEN | 418731 | 07263 | F4702/34702 | 1 | 1 | |
| U4② | IC, TTL, QUAD, 2-INPUT OR GATE | 393108 | 01295 | SN74LS32N | 1 | 1 | |
| W1 | CABLE ASSEMBLY, RS-232-C | 468637 | 89536 | 468637 | 1 | | |
| XU1 | SOCKET, 40-PIN | 418988 | 91506 | 340-AQ39D | 1 | | |
| Y1 | CRYSTAL, 2.4576 MHZ | 474825 | 89536 | 474825 | 1 | | |

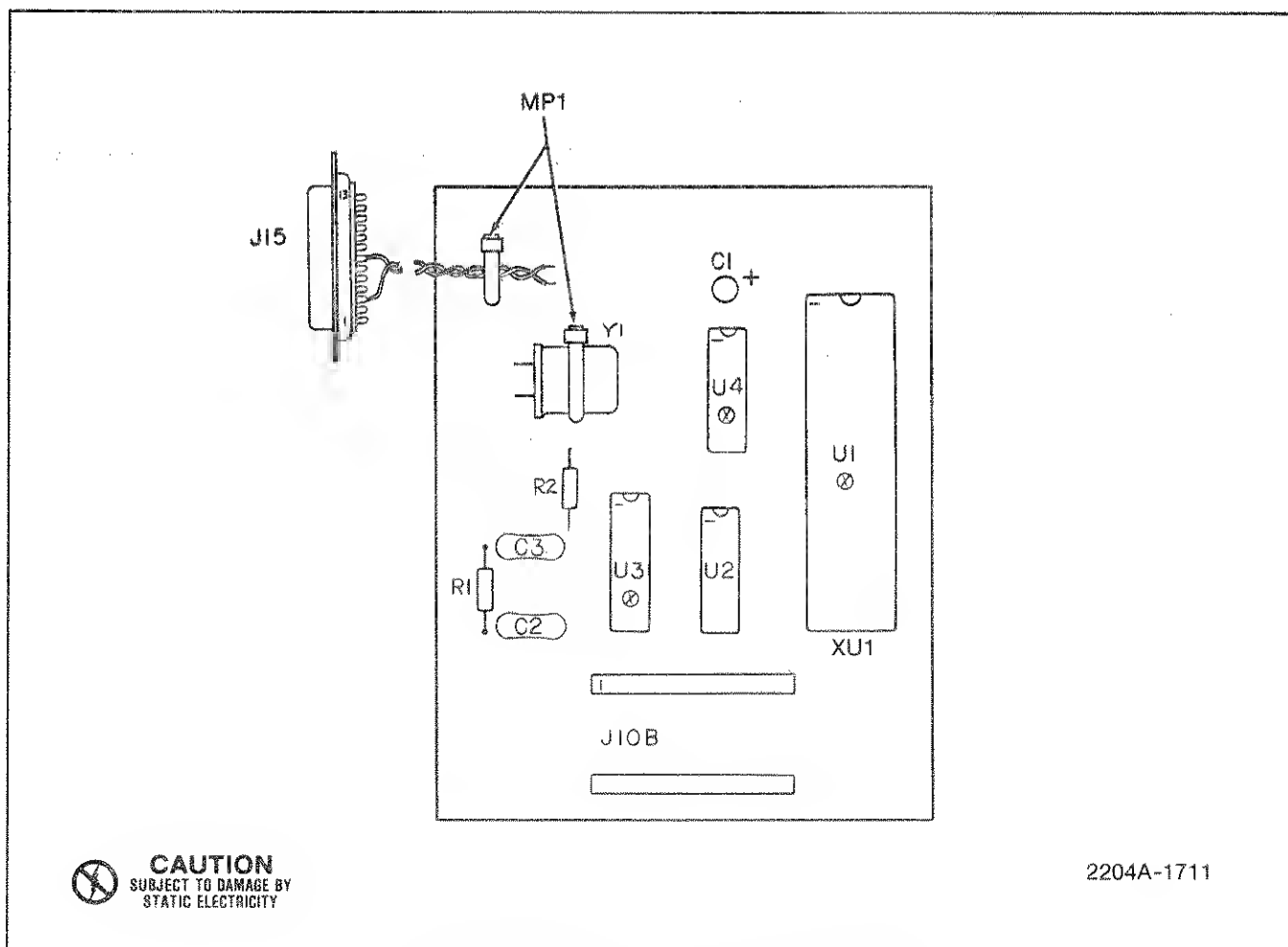


Figure 060-3. RS-232C Interface PCB Assembly

Option 2205A-100 Actuator Module

100-1. INTRODUCTION

100-2. The Actuator Module (Option 2205A-100) is a general purpose relay card design to provide the 2205A control of external switching functions. The five independently controlled relays can control power lines, signal lines, and other control lines in an automatic test equipment environment. The module consists of an actuator pcb and an input connector.

100-3. The Actuator PCB is a plug-in, relay pcb that is used for programmable control of medium-power signal and control lines. The five relays have form C contacts brought out to screw-type terminals on the Actuator Connector. These contacts do not connect to the internal scanner buses of the 2205A.

100-4. SPECIFICATIONS

100-5. The specifications for the Actuator Module are listed in Table 100-1.

100-6. INPUT CONNECTIONS

100-7. Analog interface connections are completed through an input connector with screw-type terminals. Figure 100-1 identifies the relay contacts brought out to five terminal blocks on the input connector. An extra terminal block is provided for additions by the user. Access to the screw-type terminals on the connector pcb is accomplished by removing the four screws from the decal side of the connector enclosure. The normally closed contacts (even numbered channels) refer to the state of the relay when the controller mainframe is powered up or the module is reset. The channel numbering is used for the programming of the Actuator PCB (see Theory of Operation). As connections are made to the terminals, the user can identify the block assignment (the logical location in the system) and the use of each contact on the connector decal.

100-8. INSTALLATION

100-9. The Actuator Module is installed in two parts. First the actuator pcb is installed, followed by the connector.

Table 100-1. Option -100 Specifications

| | |
|-------------------------------|---|
| Hardware | One each Actuator PCB and Actuator Connector. |
| Switching | Any combination of the five relays may be enabled. Each relay is latched on individually until it receives its individual reset command. A common Block Reset can reset all the relays at once. |
| Switch Life | Less than 2×10^5 operations at rated load. |
| Contact Resistance | Less than $.15\Omega$, typical. |
| Contact Current | 1 amp maximum. |
| Input Voltage Limit | 60V dc or 30V ac maximum. |
| Rated Load | 1 amp at 26V dc or 30V ac. |
| Over Current Protection | Fused at 3 amp. |

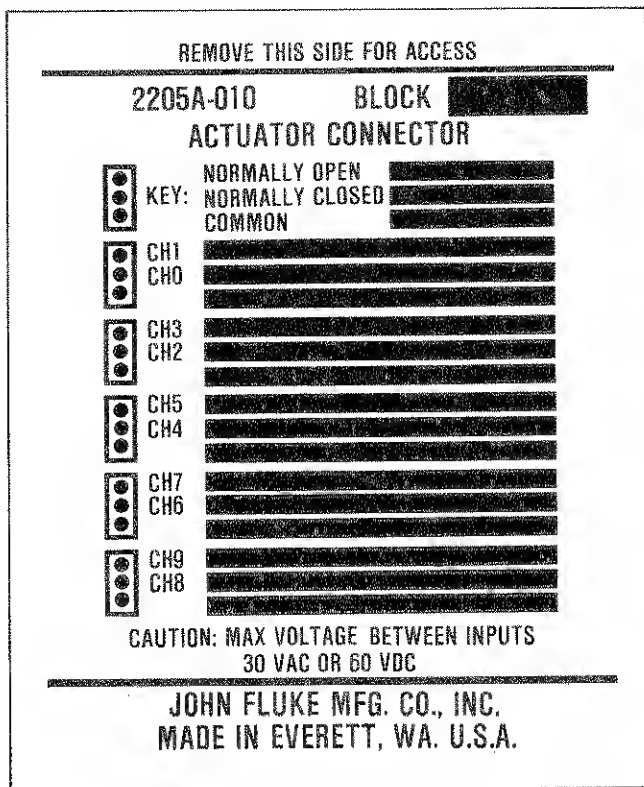


Figure 100-1. Input Connector Terminals

100-10. The Actuator PCB can be installed in any one of the available slots in the controller mainframe. Install the pcb as follows:

WARNING

REMOVE LINE POWER AND ALL OTHER HIGH VOLTAGE INPUTS TO THE CONTROLLER MAINFRAME BEFORE STARTING THIS PROCEDURE.

1. Remove the top dust cover from the controller mainframe.
2. Remove the guard chamber cover.

CAUTION

Handle the actuator pcb by its edges to avoid contaminating the pcb with oil from the hands. The use of gloves is recommended.

3. Select the slot that includes the logical block of channels the actuator pcb is to represent. Align the pcb in the slot so that the 44-pin board-edge connector is toward the rear of the unit, and the small offset board-edge connectors are toward the bottom of the unit. Push the pcb straight down onto the mating connectors.

4. Install the guard chamber cover.
5. Install the top dust cover.

100-11. The Actuator Connector and user cable assembly can be installed in any one of the controller mainframe slots that contain an actuator pcb. Install the connector as follows:

1. Unlatch the slide fasteners located on either side of the protruding enclosure at the rear of the controller mainframe.
2. Remove the enclosure from the rear panel.
3. Locate the desired slot on the rear panel and check to ensure that an actuator pcb is installed in the slot.
4. With the connector key toward the top, position the connector in the guides of the selected slot and mate it with the connector of the actuator pcb.
5. Install the retaining screw and washer that hold the input connector to the controller mainframe.
6. Install the rear panel enclosure.

100-12. OPERATION

100-13. Once installed, the Actuator Module requires no operator attention.

100-14. THEORY OF OPERATION

100-15. The Actuator Module (Figure 100-2) is a plug-in programmable relay card designed to provide latched relay closures under the control of the mainframe. These closures can be used to control external equipment or for switching input and output signal lines. The five form C relays are independently switched and the contacts are brought out on the actuator connector (there is no contact with the internal bus) for connection to external lines. Each relay is set or reset by addressing the proper latch.

100-16. All pcbs installed in the controller mainframe and/or extender chassis receive bcd channel-select information in parallel form on a 4-bit data bus (CS0-CS3). This data is decoded on each actuator pcb into five command lines and individually latched. The command lines are buffered by the relay drivers and connected to the five relay coils. Even though the channel-select data is present, the relay is not energized until the module receives a block-select (BSX) command to latch in the channel-select data.

100-17. Channel select data entered from the front panel of the controller mainframe (or remotely) turns the individual relays on and off. Each relay is toggled by a

particular pair of channel selects. The Actuator Connector decal shows the channel pairs for each relay. Selecting an odd numbered channel energizes the relay. Selecting an even numbered channel de-energizes the relay. The even numbered channels are normally closed on mainframe power up or by a BLOCK RESET.

100-18. The individual latching of each relay makes it possible to have more than one relay energized at a time. When a channel has been selected, that relay is latched. Additional relays may be energized by subsequent channel selects. Pushing the BLOCK RESET button returns all the relays on the pcb to their normal state.

100-19. MAINTENANCE

100-20. Introduction

100-21. The following paragraphs cover the access and performance test information for maintaining the switch module.

100-22. Access Information

100-23. Refer to the installation information given earlier for switch module access information. Remove the

rear panel input connector before attempting to remove the switch module pcb from its slot.

100-24. Performance Test

100-25. The performance test is designed to verify the overall operation of the Actuator Module Assembly, and is intended for use as an acceptance test and/or periodic maintenance check. The equipment used in the test is listed in Table 100-2. If the actuator module fails any part of the test, corrective action is required. The performance test is conducted as follows:

1. Remove the top cover of the Actuator Connector and set it aside during the test.
2. Install the Actuator PCB and Actuator Connector in the channel 0-9 slot of the controller mainframe.
3. Select channel 0.
4. Push the BLOCK RESET button on the controller mainframe to reset all the relays on the pcb.

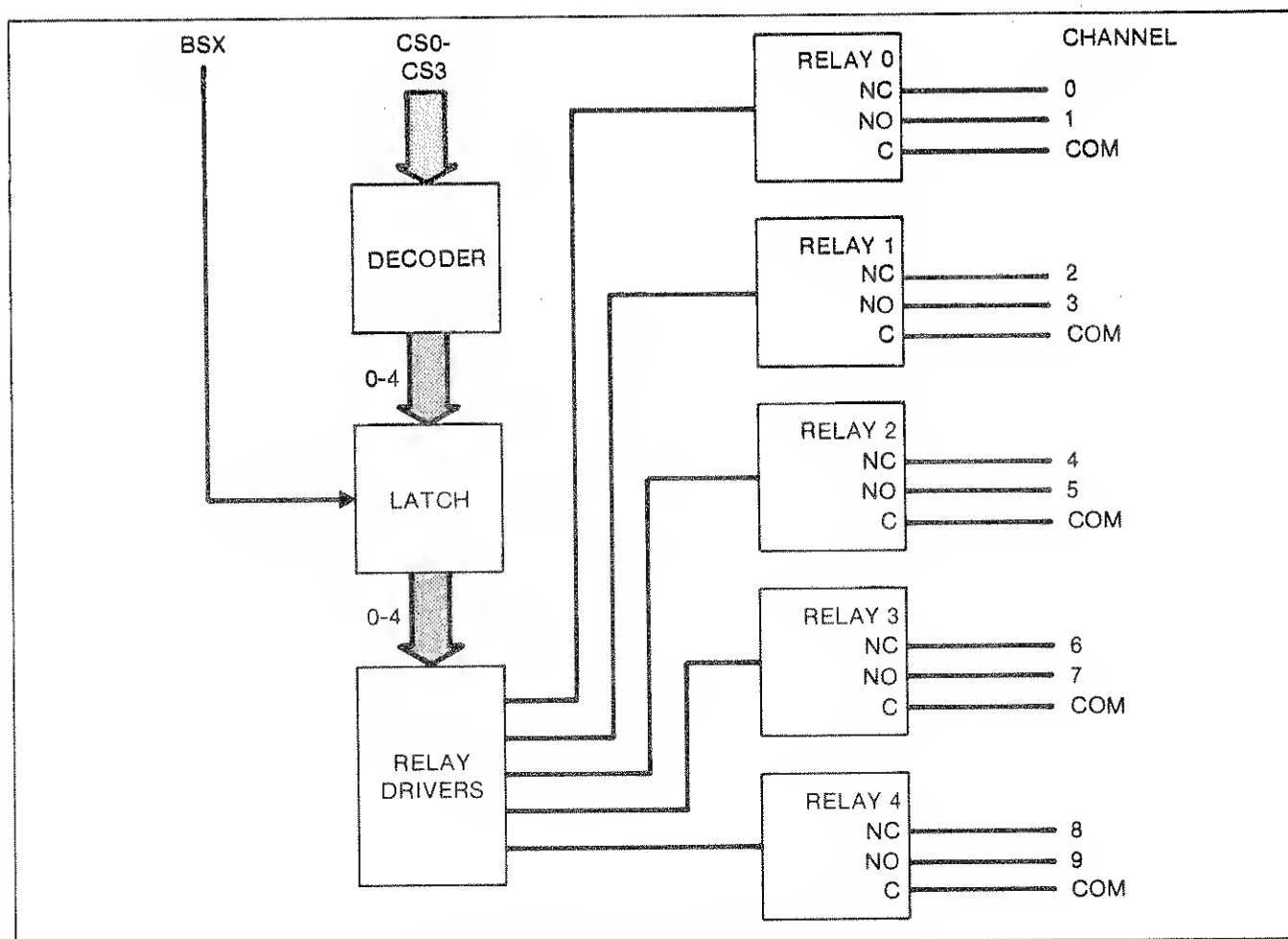


Figure 100-2. Functional Block Diagram

Table 100-2. Required Test Equipment

| INSTRUMENT | RECOMMENDED MODEL |
|------------|-------------------|
| DMM | Fluke 8520A |
| Mainframe | Fluke 2205A |

5. Set the DMM to the 2-ohm range.

6. Connect the DMM to the normally closed (even numbered channel) and common contacts on the first terminal block of the connector. The meter should read 2 ohms or less.

7. Repeat Step 6 for all of the even numbered channels on the remaining terminal blocks of the connector.

8. Select all of the odd numbered channels (1, 3, 5, 7, 9).

9. Repeat Step 6 for the odd numbered channels (normally open contacts) on each of the terminal blocks of the connector.

100-26. LIST OF REPLACEABLE PARTS

100-27. The replaceable parts of the Actuator Module Assembly are listed in Table 100-3. Refer to Section 6 of this manual for ordering information.

CAUTION



Indicated devices are subject to damage by static discharge.

Table 100-3. Actuator PCB Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|---------------------------------|-----------------------|---------------------|--------------|------------|------------|------------------|
| -100② | ACTUATOR MODULE FIGURE 100-3 | ORDER | BY | OPTION -100 | | | |
| -100A1② | ACTUATOR PCB ASSEMBLY | 639773 | 89536 | 612234 | 1 | | |
| -100A2 | SCREW TERMINAL CONNECTOR | 618843 | 89536 | 618843 | 1 | | |
| H1 | SCREW, PHP, 4-40 X 7/8 | 335133 | 89536 | 335133 | 2 | | |
| H2 | SCREW, PHP, 6-32 X 1/4 | 152140 | 89536 | 152140 | 8 | | |
| H3 | WASHER, FLAT, #4 | 146225 | 89536 | 146225 | 2 | | |
| MP1 | DECAL, ACTUATOR CONNECTOR | 632141 | 89536 | 632141 | 1 | | |
| MP2 | ISOTHERMAL CONNECTOR HOUSING | 414276 | 89536 | 414276 | 2 | | |

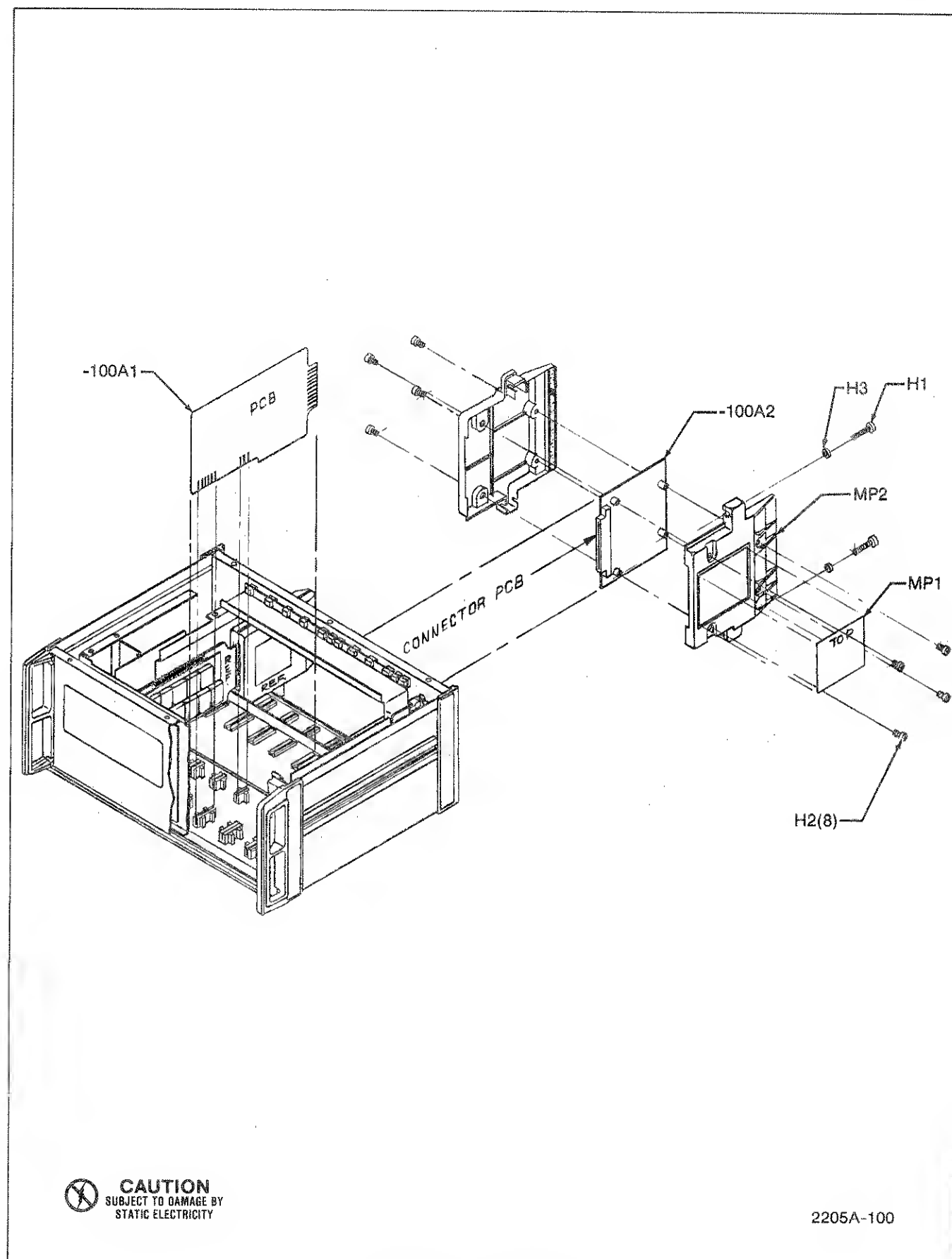
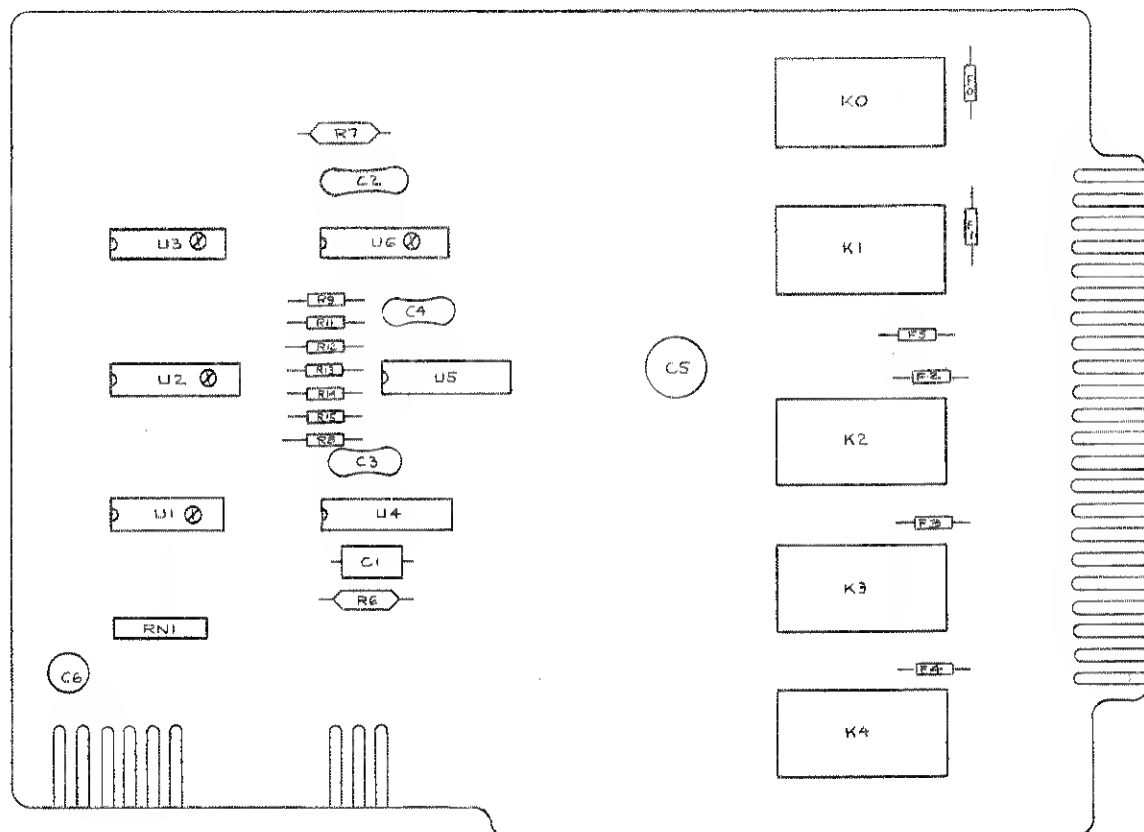


Figure 100-3. Actuator Module

Figure 100-4. Actuator PCB Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFD PART NO. | TOT QTY | REC QTY | N O T E |
|------------|---|-----------------------|---------------------|----------------|------------|------------|------------------|
| -100A1② | ACTUATOR PCB ASSEMBLY FIGURE 100-4 (2205A-4002T) | 639773 | 89536 | 612234 | REF | | |
| C1 | CAP, ELECT, TA, 1 UF +/-5%, 15V | 461152 | 56289 | 150D106X5015A2 | 1 | | |
| C2 | CAP, MICA, 3000 PF +/-5%, 500V | 161786 | 72136 | DM19F302J | 1 | | |
| C3 | CAP, MICA, 220 PF +/-5%, 500V | 170423 | 72136 | DM15F22J | 2 | | |
| C4 | CAP, MICA, 220 PF +/-5%, 500V | 170423 | 72136 | DM15F22J | REF | | |
| C5 | CAP, ELECT, 15 UF +/-20%, 35V | 614024 | 89536 | 614024 | 2 | | |
| C6 | CAP, ELECT, 15 UF +/-20%, 35V | 614024 | 89536 | 614024 | REF | | |
| F0 | FUSE, PICO, 3A, 125V | 460915 | 71400 | GFA3 | 5 | | |
| F1 | FUSE, PICO, 3A, 125V | 460915 | 71400 | GFA3 | REF | | |
| F2 | FUSE, PICO, 3A, 125V | 460915 | 71400 | GFA3 | REF | | |
| F3 | FUSE, PICO, 3A, 125V | 460915 | 71400 | GFA3 | REF | | |
| F4 | FUSE, PICO, 3A, 125V | 460915 | 71400 | GFA3 | REF | | |
| F5 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | 1 | | |
| K0 | RELAY, ULTRA SENSITIVE, SPDT | 603282 | 26806 | AZ 2530-08-52 | 5 | | |
| K1 | RELAY, ULTRA SENSITIVE, SPDT | 603282 | 26806 | AZ 2530-08-52 | REF | | |
| K2 | RELAY, ULTRA SENSITIVE, SPDT | 603282 | 26806 | AZ 2530-08-52 | REF | | |
| K3 | RELAY, ULTRA SENSITIVE, SPDT | 603282 | 26806 | AZ 2530-08-52 | REF | | |
| K4 | RELAY, ULTRA SENSITIVE, SPDT | 603282 | 26806 | AZ 2530-08-52 | REF | | |
| R6 | RES, MTL. FILM, 953 +/-1%, 1/8W | 288563 | 91637 | CMF559530F | 1 | | |
| R7 | RES, MTL. FILM, 681K +/-1%, 1/8W | 381517 | 91637 | CMF556813F | 1 | | |
| R8 | RES, COMP, 100K +/-5%, 1/4W | 348920 | 01121 | CB1045 | 2 | | |
| R9 | RES, COMP, 100K +/-5%, 1/4W | 348920 | 01121 | CB1045 | REF | | |
| R11 | RES, DEP. CAR, 1K +/-5%, 1/4W | 343426 | 80031 | CR251-4-5P1K | 5 | | |
| R12 | RES, DEP. CAR, 1K +/-5%, 1/4W | 343426 | 80031 | CR251-4-5P1K | REF | | |
| R13 | RES, DEP. CAR, 1K +/-5%, 1/4W | 343426 | 80031 | CR251-4-5P1K | REF | | |
| R14 | RES, DEP. CAR, 1K +/-5%, 1/4W | 343426 | 80031 | CR251-4-5P1K | REF | | |
| R15 | RES, DEP. CAR, 1K +/-5%, 1/4W | 343426 | 80031 | CR251-4-5P1K | REF | | |
| RN1 | RES NET, 100K +/-2%, 1/8W | 412726 | 89536 | 412726 | 1 | | |
| U1② | IC, C-MOS, QUAD 2-INPUT NAND GATE | 418509 | 12040 | MM74C00N | 1 | | |
| U2② | IC, C-MOS 8-BIT ADDRESSABLE LATCH 16-PIN | 453258 | 02735 | CD4099BE | 1 | | |
| U3② | IC, COS/MOS, QUAD, 2-INPUT NOR GATES | 355172 | 02735 | CD4001AE | 1 | | |
| U4② | IC, C-MOS, MONOSTABLE MV | 454017 | 04713 | MC14538BCP | 2 | | |
| U5 | IC, LINEAR, NPN 5-XSTR ARRAY | 418574 | 02735 | CA3083E | 1 | | |
| U6② | IC, C-MOS, MONOSTABLE MV | 454017 | 04713 | MC14538BCP | REF | | |



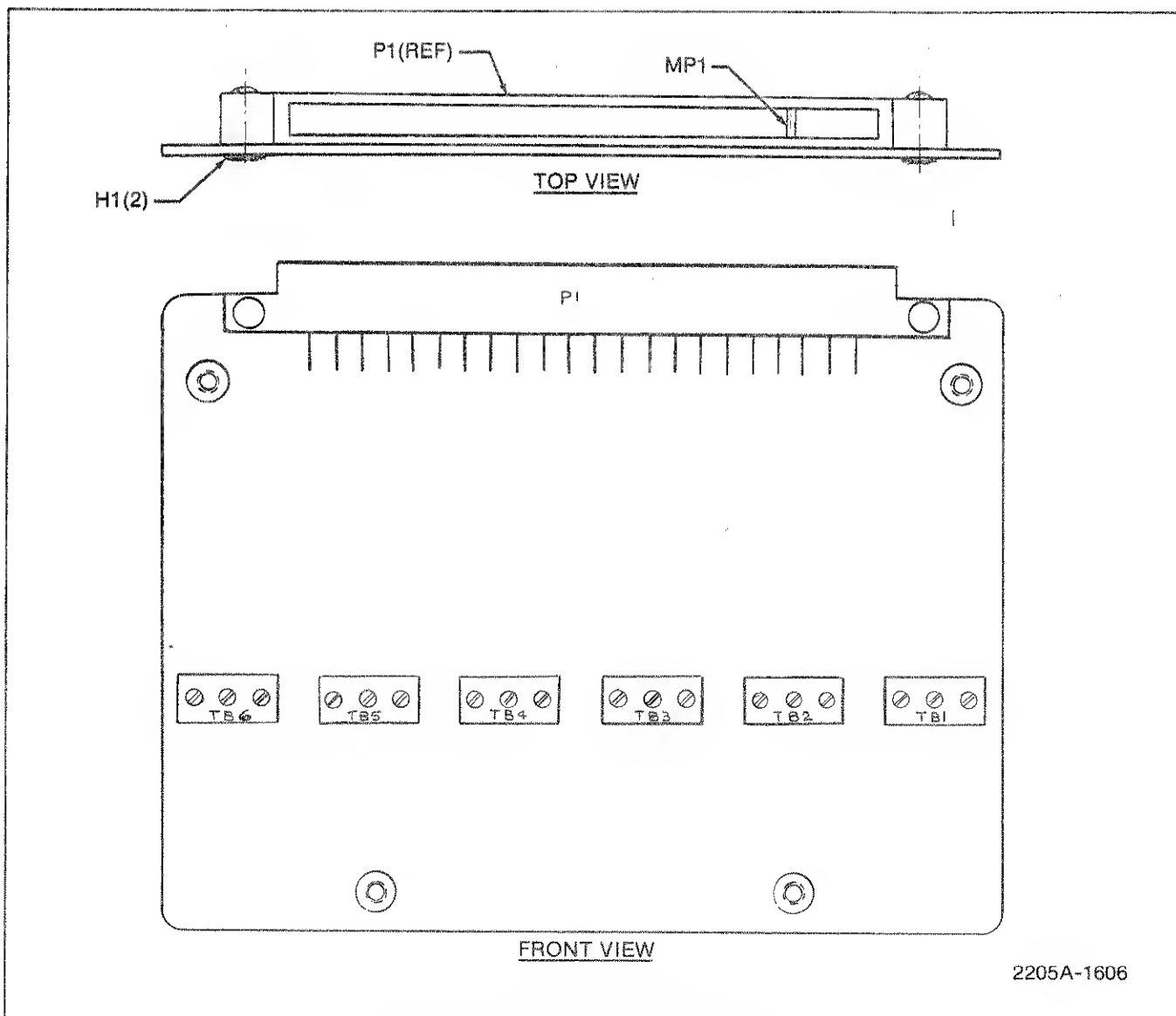
 **CAUTION**
SUBJECT TO DAMAGE BY
STATIC ELECTRICITY

2205A-1602

Figure 100-4. Actuator PCB Assembly

Table 100-5. Screw Terminal Connector

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|---|-----------------------|---------------------|--------------|------------|------------|------------------|
| -100A2 | SCREW TERMINAL CONNECTOR FIGURE 100-5 (2205A-4006) | 618843 | 89536 | 618843 | REF | | |
| H1 | WASHER, #4 | 147728 | 89536 | 147728 | 2 | | |
| MP1 | KEY, POLARIZING | 961060 | 00779 | 530374-1 | 1 | | |
| P1 | CONNECTOR, 44-PIN | 602839 | 54453 | EYM-22-DRAS | 1 | | |
| TB1 | TERMINAL STRIP, 3-PIN | 615344 | 89536 | 615344 | 6 | | |
| TB2 | TERMINAL STRIP, 3-PIN | 615344 | 89536 | 615344 | REF | | |
| TB3 | TERMINAL STRIP, 3-PIN | 615344 | 89536 | 615344 | REF | | |
| TB4 | TERMINAL STRIP, 3-PIN | 615344 | 89536 | 615344 | REF | | |
| TB5 | TERMINAL STRIP, 3-PIN | 615344 | 89536 | 615344 | REF | | |
| TB6 | TERMINAL STRIP, 3-PIN | 615344 | 89536 | 615344 | REF | | |



2205A-1606

Figure 100-5. Screw Terminal Connector

Option 2205A-200 Latching Module

200-1. INTRODUCTION

200-2. The Latching Module (Option 2205A-200) is a general purpose relay pcb that can be configured into a variety of matrices. The Latching Module, in its basic form, is a dual 1-by-4 matrix with all lines brought out on the General Purpose Connector to allow the user to develop any size matrix externally. The module is isolated from internal scanner bus in the 2205A. The module consists of a latching pcb and a general purpose connector.

200-3. The Latching PCB is a plug-in relay pcb that operates as a basic multiplexer, de-multiplexer, or as a

matrix building block. Eight 2-wire (high and low) relays select which input channel(s) is to be connected to the common bus of the connector (not the internal bus of the controller).

200-4. The General Purpose Connector is a screw-type terminal connector designed for inputting signal lines to the switch module. Jumpers on the connector pcb allow the Latching Module to be configured into different types of matrices.

200-5. SPECIFICATIONS

200-6. The specifications for the Latching Module are listed in Table 200-1.

Table 200-1. Option -200 Specifications

| | |
|-------------------------------|--|
| Hardware | One each Latching PCB and General Purpose Connector. |
| Channels | Two groups of four each 2-wire reed relays. The relays connect each channel to a common bus (brought out on the connector, not the internal scanner bus in the 2205A) to form a dual 1-by-4 matrix. Jumpers allow configuration of 1x4, 2x4, 1x8 matrices. |
| Switching | Any combination of the eight relays may be enabled. Each relay is latched individually until that group (4 relays) receives a Block Reset command. |
| Switch Life | Greater than 10^7 operations at 40V, 1 mA load. |
| Rated Load | 10 mA at input voltage limit. |
| Contact Resistance | Typical 1Ω for high plus low paths. |
| Contact Current | 40 mA maximum. |
| Bandwidth | ± 0.1 dB from 600Ω to 1 M Ω . Typical -0.2 dB at 50 Ω . |
| Offset Voltage | Total offset from channel to channel or channel to bus is $<10\mu\text{V}$. |
| Input Voltage Limit | 170V dc or peak ac. |
| Over Current Protection | Fused at 0.5 amp. |

200-7. INPUT CONNECTIONS

200-8. The analog interface to the module is completed through a general purpose connector with screw-type terminals. Figure 200-1 identifies the location of the terminals for the 8 latching channels on the left side of each terminal block. Channels 0 through 3 are switched on to and off of bus A, while channels 4 through 7 are switched on to and off of bus B. These buses are isolated from the internal scanner bus. Access to the terminal blocks is accomplished by removing the four screws from the decal side of the connector enclosure. The high, low, and shield connections for each channel are identified next to the terminal blocks on the pcb inside the connector enclosure. Each of the signal lines has a 0.5 amp fuse for current protection.

200-9. Jumpers J1 through J11 are used in making the necessary connections between channels and buses to form the desired matrix. Table 200-2 shows the jumper configuration for the possible matrices.

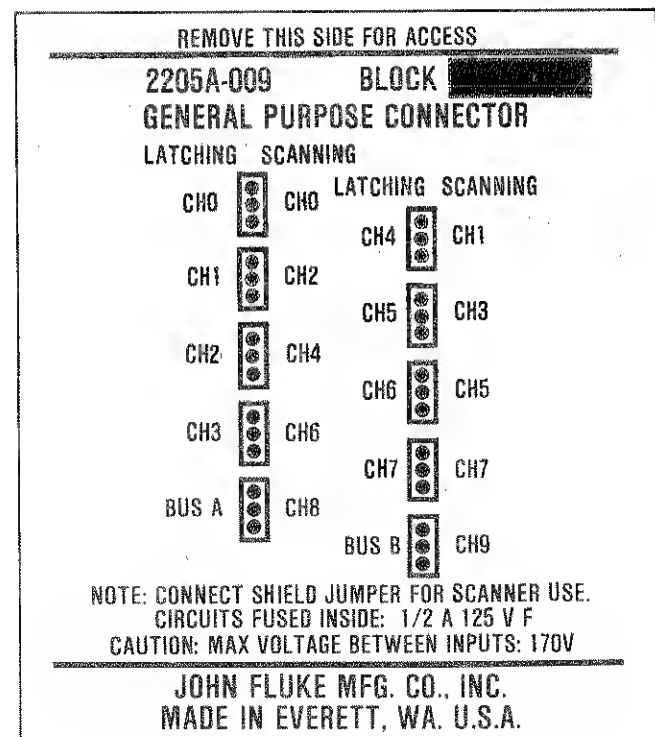


Figure 200-1. Input Connector Terminals

Table 200-2. Matrix Connections

| MATRIX SIZE | INSTALL JUMPERS |
|----------------------------|-----------------|
| Dual 1x4 | J11 |
| Dual 1x4 (isolated guards) | — |
| 1x8 | J9-J11 |
| 2x4 | J1-J8, J11 |

200-10. INSTALLATION

200-11. The Latching Module is installed in two parts. The latching pcb is installed first, followed by the connector.

200-12. The Latching PCB can be installed in any one of the available slots in the controller mainframe. Install the latching pcb as follows:

WARNING

REMOVE LINE POWER AND ALL OTHER HIGH VOLTAGE INPUTS TO THE CONTROLLER MAINFRAME BEFORE STARTING THIS PROCEDURE.

1. Remove the top dust cover from the controller mainframe.
2. Remove the guard chamber cover.

CAUTION

Handle the latching pcb by its edges to avoid contaminating the pcb with oil from the hands. The use of gloves is recommended.

3. Select the slot that includes the logical block of channels that the latching pcb is to represent. Align the pcb in the slot so that the 44-pin board-edge connector is toward the rear of the unit, and the small offset board-edge connectors are toward the bottom of the unit. Push the pcb straight down onto the mating connectors.

4. Install the guard chamber cover.
5. Install the top dust cover.

200-13. The General Purpose Connector and user cable assembly can be installed in any one of the controller mainframe slots that contain a latching pcb. Install the connector as follows:

1. Unlatch the slide fasteners located on either side of the protruding enclosure at the rear of the controller mainframe.
2. Remove the enclosure from the rear panel.
3. Locate the desired slot on the rear panel and check to ensure that a latching pcb is installed in the slot.
4. With the connector key toward the top, position the connector in the guides of the selected slot and mate it with the connector on the latching pcb.

5. Install the retaining screw and washer that hold the input connector to the controller mainframe.

6. Install the rear panel enclosure.

200-14. OPERATION

200-15. Once installed, the Latching Module requires no operator attention.

200-16. THEORY OF OPERATION

200-17. The Latching Module (Figure 200-2) is a programmable, dual 1-by-4 relay matrix. The matrix is made up of two groups of four relays each. The relays are addressable, 2-wire, form-A, reed relays that switch each of the channel inputs (or outputs) onto their associated bus. The shield of channels 0 through 3 are tied to the shield of bus A and the shield of channels 4 through 7 are tied to the shield of bus B. Jumper J11 on the input connector must be cut if the shields of bus A need to be isolated from the shields of bus B. The remaining jumpers (J1 through J10) on the input connector are used for connecting channels and buses of the latching module in a matrix of X-by-Y channels. See the Input Connections information presented earlier in this section for more information on matrix configurations.

200-18. All pcbs installed in the controller mainframe and/or extender chassis receive bcd channel select information in parallel form on a 4-bit data bus (CS0 through CS3). This data is decoded on each latching pcb by two 1-of-4 decoders into eight channel commands. Each command line is then individually latched, buffered, and connected to one of the relay coils. Even though the channel select data is present, the relay is not energized unless the latching module receives a block-select (BSX) command to latch the channel select data.

200-19. The individual latching of each relay makes it possible to have more than one relay energized at a time. When a channel has been selected, that relay is latch on. Additional relays may be energized by subsequent channel selects. The latch must be reset to de-energize any relay. Selecting channel 8 of that block resets latches 0-3. Selecting channel 9 of that block resets latches 4-7. All channels are reset by the BLOCK RESET button on the mainframe. If two channels are selected on the same bus, and only one is to be de-energized, then a reset followed by a channel select must occur. For example, when channel 0 and channel 1 are both on, selecting channel 8 turns both relays off. If only channel 0 was to be turned off, a channel 1 select must be entered next.

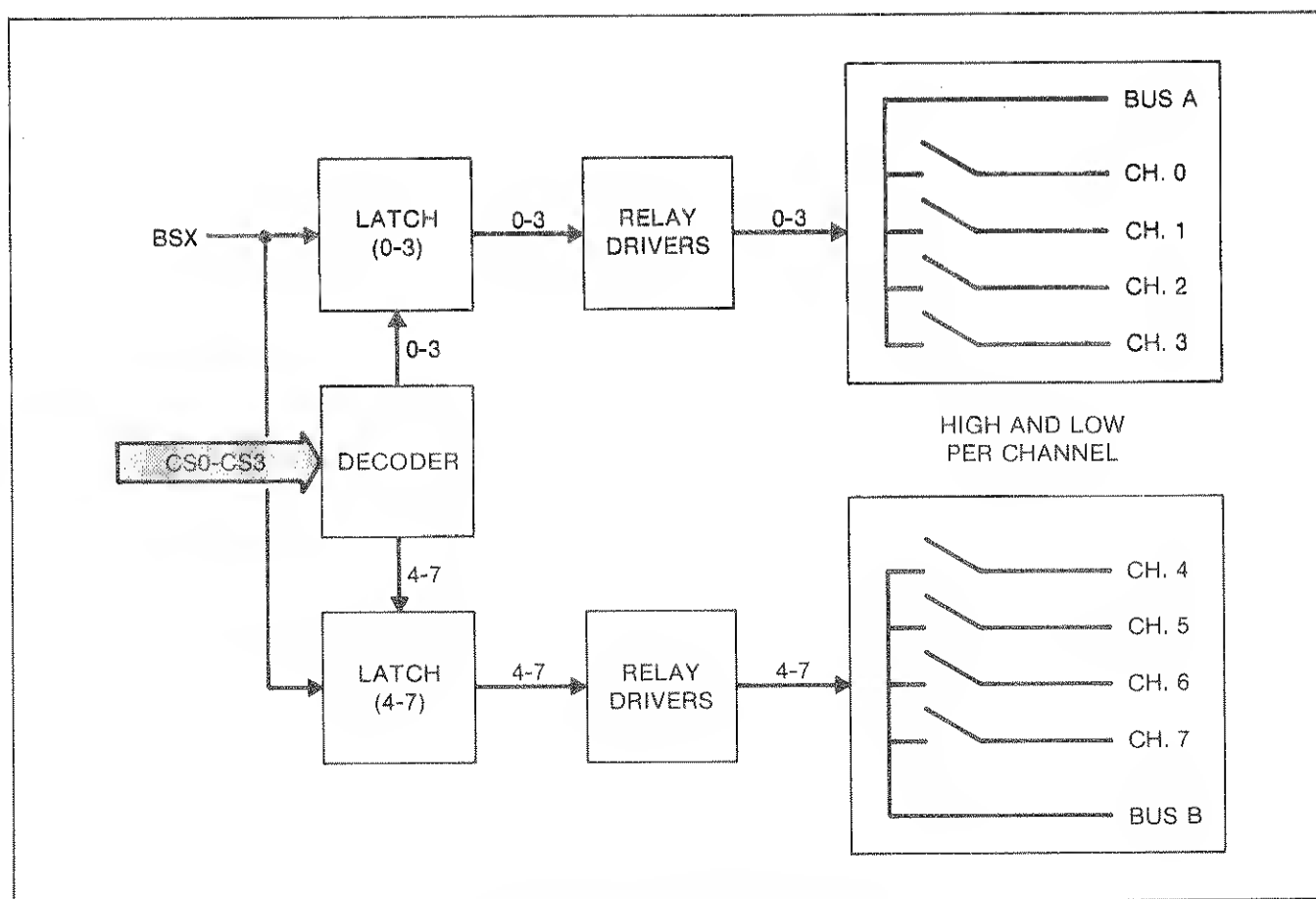


Figure 200-2. Functional Block Diagram

200-20. MAINTENANCE

200-21. Introduction

200-22. The following paragraphs cover the access and performance test information for maintaining the switch module.

200-23. Access Information

200-24. Refer to the Installation information given earlier in this section for switch module access information. Remove the rear panel input connector before attempting to remove the switch module pcb from its slot.

200-25. Performance Test

200-26. The performance test is designed to verify the overall operation of the Latching Module Assembly, and is intended for use as an acceptance test and/or periodic maintenance check. The equipment used in the test is listed in Table 200-3. If the latching module fails any part of the test, corrective action is required. The performance test is conducted as follows:

1. Fabricate a test cable and connector as shown in Figure 200-3.

NOTE

Jumpers J1 thru J8 must be installed and jumpers J9 and J10 must be cut.

2. Install the Latching Module and the test cable in the channel 0-9 slot of the controller mainframe.
3. Set the DMM to the 2 ohm range.
4. Connect the test cable leads to the DMM.
5. Push the BLOCK RESET button to reset all the relays on the pcb.
6. Manually select channel 0 and channel 4. The DMM should read 2 ohms or less.
7. Manually select the remaining channels by first pushing the BLOCK RESET button and then selecting the next channel pair (1 & 5, 2 & 6, 3 & 7). A reading of 2 ohms or less should be observed on each of the channel pairs. Any deviation in this pattern indicates a defective pcb.

Table 200-3. Required Test Equipment

| INSTRUMENT | RECOMMENDED MODEL |
|------------|-------------------|
| DMM | Fluke 8520A |
| Mainframe | Fluke 2205A |

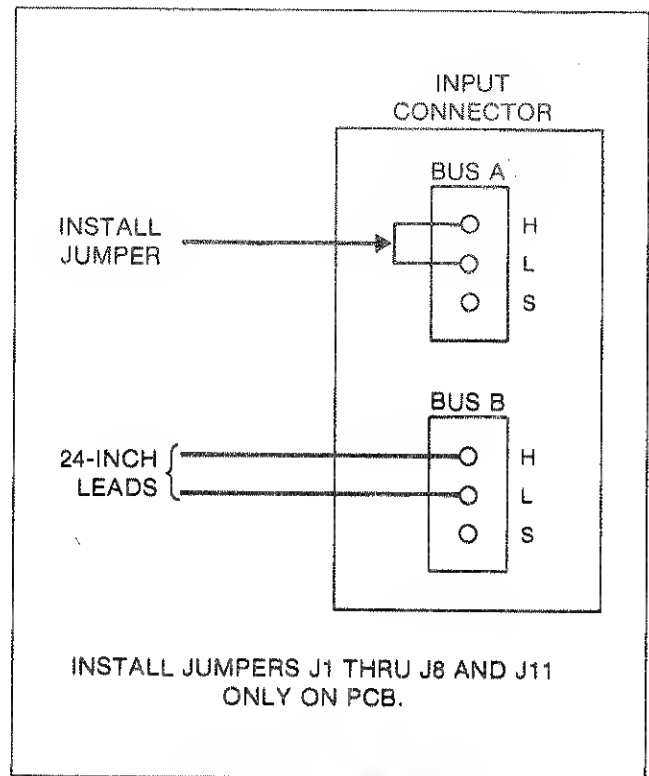


Figure 200-3. Test Cable

200-27. LIST OF REPLACEABLE PARTS

200-28. The replaceable parts of the Latching Module Assembly are listed in Table 200-4. Refer to Section 6 of this manual for ordering information.

CAUTION

Indicated devices are subject to damage by static discharge.

Table 200-4. Latching Module

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|----------------------------------|-----------------------|---------------------|--------------|------------|------------|------------------|
| -200② | LATCHING MODULE FIGURE 200-4) | ORDER | BY | OPTION -200 | | | |
| -200A1② | LATCHING PCB ASSEMBLY | 639781 | 89536 | 612242 | 1 | | |
| -200A2 | FUSED TERMINAL CONNECTOR | 618876 | 89536 | 618876 | 1 | | |
| H1 | SCREW, PHP, 4-40 X 7/8 | 335133 | 89536 | 335133 | 2 | | |
| H2 | SCREW, PHP, 6-32 X 1/4 | 152140 | 89536 | 152140 | 8 | | |
| H3 | WASHER, FLAT | 146225 | 89536 | 146225 | 2 | | |
| MP1 | DECAL, GENRAL PURPOSE CONN. | 632133 | 89536 | 632133 | 1 | | |
| MP2 | ISOTHERMAL CONNECTOR HOUSING | 414127 | 89536 | 414127 | 2 | | |

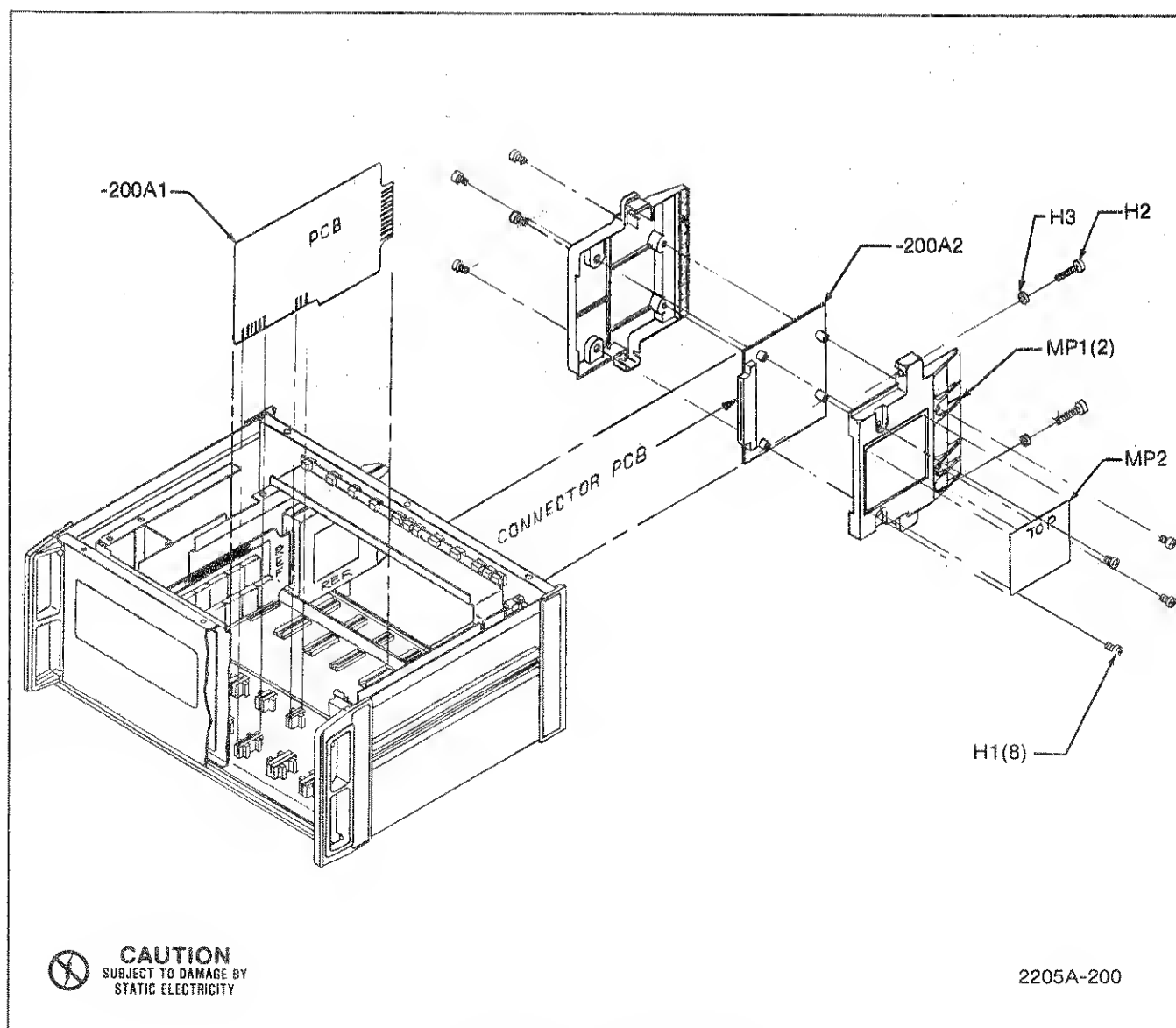
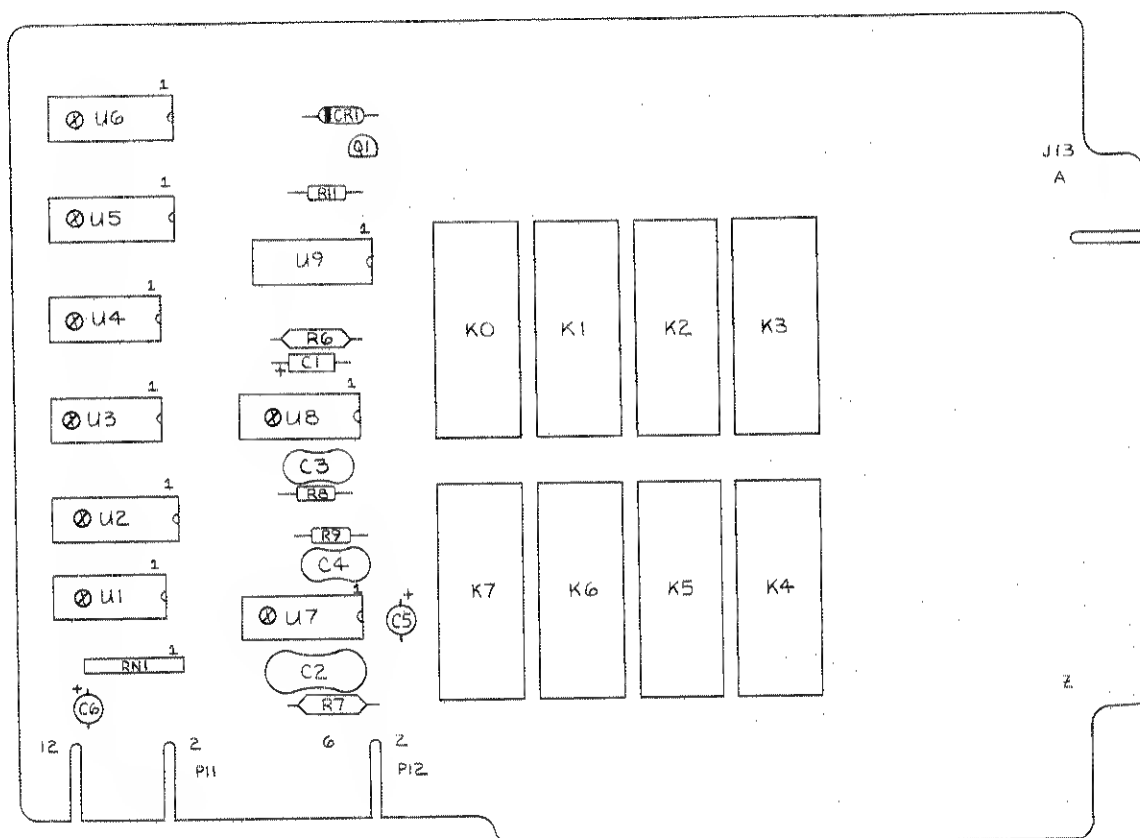


Figure 200-4. Latching Module

Table 200-5. Latching PCB Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|---|-----------------------|---------------------|----------------|------------|------------|------------------|
| -200A10 | LATCHING PCB ASSEMBLY FIGURE 200-5 (2205A-4003T) | 639781 | 89536 | 612242 | REF | | |
| C1 | CAP, ELECT, TA, 1 UF +/-5%, 15V | 461152 | 56289 | 150D106X5015A2 | 1 | | |
| C2 | CAP, MICA, 3000 PF +/-5%, 500V | 161786 | 72136 | DM19F302J | 1 | | |
| C3 | CAP, MICA, 220 PF +/-5%, 500V | 170423 | 72136 | DM15F221J | 2 | | |
| C4 | CAP, MICA, 220 PF +/-5%, 500V | 170423 | 72136 | DM15F221J | REF | | |
| C5 | CAP, ELECT, 15 UF +/-20%, 35V | 614024 | 89536 | 614024 | 2 | | |
| C6 | CAP, ELECT, 15 UF +/-20%, 35V | 614024 | 89536 | 614024 | REF | | |
| CR1 | DIODE, HI-SPEED SWITCHING | 203323 | 04713 | 1N4448 | 1 | 1 | |
| K0 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | 8 | | |
| K1 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K2 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K3 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K4 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K5 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K6 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K7 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| Q1 | TRANSISTOR, SI, NPN | 218396 | 04713 | 2N3904 | 1 | | |
| R6 | RES, MTL. FLM, 9.53K +/-1%, 1/8W | 288563 | 91637 | CMF559531F | 1 | | |
| R7 | RES, MTL. FLM, 681K +/-1%, 1/8W | 381517 | 91637 | CMF556813F | 1 | | |
| R8 | RES, COMP, 100K +/-5%, 1/4W | 348920 | 01121 | CB1045 | 2 | | |
| R9 | RES, COMP, 100K +/-5%, 1/4W | 348920 | 01121 | CB1045 | REF | | |
| R11 | RES, DEP. CAR, 3.3K +/-5%, 1/4W | 348813 | 80031 | CR251-4-5P3K3 | 1 | | |
| RN1 | RESISTOR NETWORK, 100K | 412726 | 89536 | 412726 | 1 | 1 | |
| U10 | IC, C-MOS, QUAD 2-INPUT NAND GATE | 418509 | 12040 | MM74C00N | 2 | 1 | |
| U20 | IC, C-MOS, DCDR/MULTIPLEXER | 408369 | 04713 | MC14556CP | 1 | 1 | |
| U30 | IC, COS/MOS, QUAD, 2-INPUT NOR GATES | 355172 | 02735 | CD4001AE | 1 | 1 | |
| U40 | IC, C-MOS, QUAD 2-INPUT NAND GATE | 418509 | 12040 | MM74C00N | REF | | |
| U50 | IC, C-MOS 8-BIT ADDRESSABLE LATCH 16-PIN | 453258 | 02735 | CD4099BE | 2 | 1 | |
| U60 | IC, C-MOS 8-BIT ADDRESSABLE LATCH 16-PIN | 453258 | 02735 | CD4099BE | REF | | |
| U70 | IC, C-MOS, MONOSTABLE MV | 454017 | 04713 | MC14538BCP | 2 | 1 | |
| U80 | IC, C-MOS, MONOSTABLE MV | 454017 | 04713 | MC14538BCP | REF | | |
| U9 | IC, TRANSISTOR ARRAY | 454116 | 01295 | ULN2003 | 1 | 1 | |



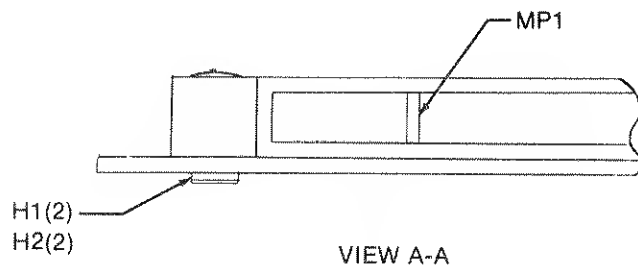
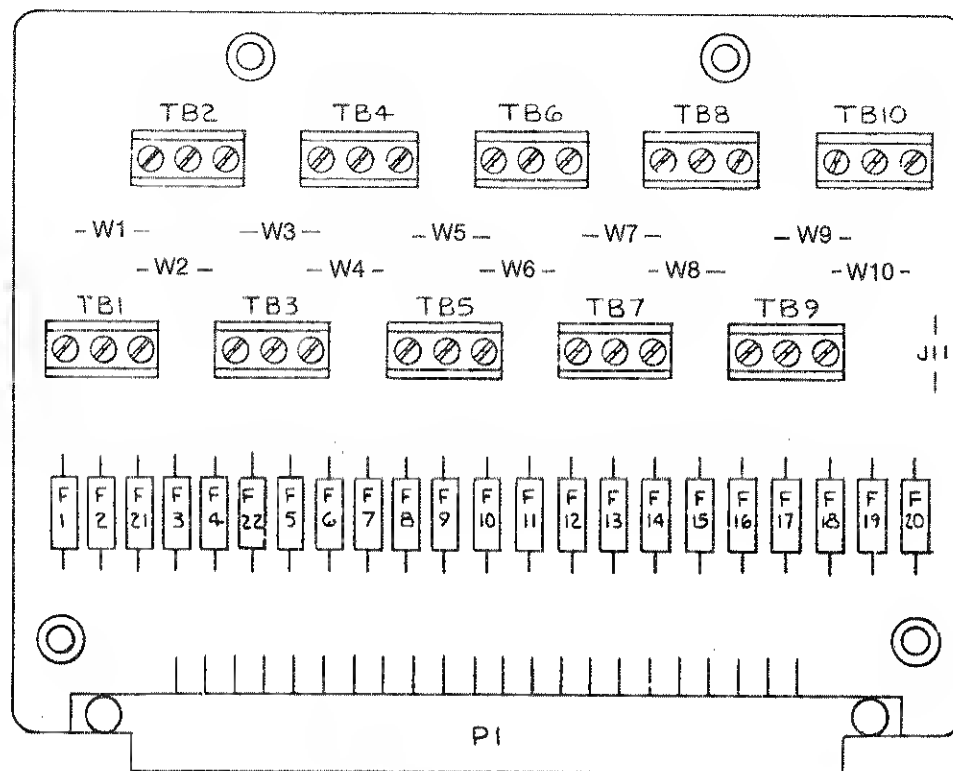
CAUTION
SUBJECT TO DAMAGE BY
STATIC ELECTRICITY

2205A-1603

Figure 200-5. Latching PCB Assembly

Table 200-6. Fused Terminal Connector

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|---|-----------------------|---------------------|--------------|------------|------------|------------------|
| -200A2 | FUSED TERMINAL CONNECTOR FIGURE 200-6 (2205A-4007) | 618876 | 89536 | 618876 | REF | | |
| F1 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | 22 | 5 | |
| F2 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F3 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F4 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F5 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F6 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F7 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F8 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F9 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F10 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F11 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F12 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F13 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F14 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F15 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F16 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F17 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F18 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F19 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F20 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F21 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| F22 | FUSE, PICO, 0.5A, 125V | 603274 | 71400 | GFA | REF | | |
| H1 | WASHER, FLAT, #4 | 147728 | 89536 | 147728 | 2 | | |
| MP1 | KEY, POLARIZING | 961060 | 00779 | 530374-1 | 1 | | |
| P1 | CONNECTOR, 44-PIN | 602839 | 54453 | KSM-22-DRA5 | 1 | | |
| TB1 | TERMINAL STRIP, 3-PIN | 615344 | 06229 | 25.102.0353 | 10 | | |
| TB2 | TERMINAL STRIP, 3-PIN | 615344 | 06229 | 25.102.0353 | REF | | |
| TB3 | TERMINAL STRIP, 3-PIN | 615344 | 06229 | 25.102.0353 | REF | | |
| TB4 | TERMINAL STRIP, 3-PIN | 615344 | 06229 | 25.102.0353 | REF | | |
| TB5 | TERMINAL STRIP, 3-PIN | 615344 | 06229 | 25.102.0353 | REF | | |
| TB6 | TERMINAL STRIP, 3-PIN | 615344 | 06229 | 25.102.0353 | REF | | |
| TB7 | TERMINAL STRIP, 3-PIN | 615344 | 06229 | 25.102.0353 | REF | | |
| TB8 | TERMINAL STRIP, 3-PIN | 615344 | 06229 | 25.102.0353 | REF | | |
| TB9 | TERMINAL STRIP, 3-PIN | 615344 | 06229 | 25.102.0353 | REF | | |
| TB10 | TERMINAL STRIP, 3-PIN | 615344 | 06229 | 25.102.0353 | REF | | |
| W1 | WIRE, JUMPER | 529206 | 89536 | 529206 | 9 | | |
| W2 | WIRE, JUMPER | 529206 | 89536 | 529206 | REF | | |
| W3 | WIRE, JUMPER | 529206 | 89536 | 529206 | REF | | |
| W4 | WIRE, JUMPER | 529206 | 89536 | 529206 | REF | | |
| W5 | WIRE, JUMPER | 529206 | 89536 | 529206 | REF | | |
| W6 | WIRE, JUMPER | 529206 | 89536 | 529206 | REF | | |
| W7 | WIRE, JUMPER | 529206 | 89536 | 529206 | REF | | |
| W8 | WIRE, JUMPER | 529206 | 89536 | 529206 | REF | | |
| W9 | WIRE, JUMPER | 529206 | 89536 | 529206 | REF | | |



VIEW A-A

2205A-1607

Figure 200-6. Fused Terminal Connector

Option 2205A-300

General Purpose Scanner Module

300-1. INTRODUCTION

300-2. The General Purpose Scanner Module (Option 2205A-300) is a plug-in relay scanner designed to operate as a general purpose analog data multiplexer. The scanner option consists of a relay scanner pcb and an input connector.

300-3. The General Purpose Scanner PCB is a plug-in, 10-channel, 2-wire relay scanner that operates as an analog data multiplexer. Switched high and low inputs are provided for each of the 10 channels and a common (unswitched) shield is provided for all 10 channels. A decoupling relay is used to isolate the high, low and shield buses from the common connections to the internal

scanner bus of the 2205A when a channel relay is not activated. Activating any one of the 10 channel relays also energizes the decoupling relay.

300-4. The General Purpose Connector is a connector assembly with screw-type terminals. The connector mounts in the rear of a controller mainframe and provides electrical contact and fused protection for both the scanning and latching type modules. Use the connector to fabricate a custom interface cable from external analog signal sources to a scanner pcb.

300-5. SPECIFICATIONS

300-6. Specifications for the General Purpose Scanner Module are listed in Table 300-1.

Table 300-1. Option -300 Specifications

| | |
|--|---|
| Hardware | One each Latching PCB and General Purpose Connector. |
| Channels | Ten 2-wire, reed relays (high and low). One each common shield and output bus decoupling relay. |
| Thermal Offset | Less than 10 μ V. |
| Bandwidth | ± 0.2 dB to 1 MHz with 1 M Ω termination. |
| Switch Life | Greater than 10^7 operations. |
| Contact Current | 40 mA maximum. |
| Input Voltage Limit* | 170V dc or peak ac. |
| Common Mode Voltage Limit (Voltage between chassis and any input) | 170V dc or peak ac maximum provided the Input Voltage Limit is not exceeded. |
| Over Current Protection | 0.5 amp fuse in series with each input line. |

* Maximum voltage between any two terminals in the system including normal mode as well as common mode voltages.

300-7. INPUT CONNECTIONS

300-8. The analog interface is completed through a general purpose connector. Figure 300-1 identifies the location of the terminals for the 10 scanning channels on the right side of each terminal block. Access to the terminal blocks is accomplished by removing the four screws from the decal side of the connector enclosure. The high, low, and shield connections for each channel are identified inside the connector enclosure next to the terminal blocks on the pcb. Each of the signal lines has a 0.5 amp fuse for current protection. Only jumper J11 should be installed in the connector pcb to use the input connector with a scanner pcb.

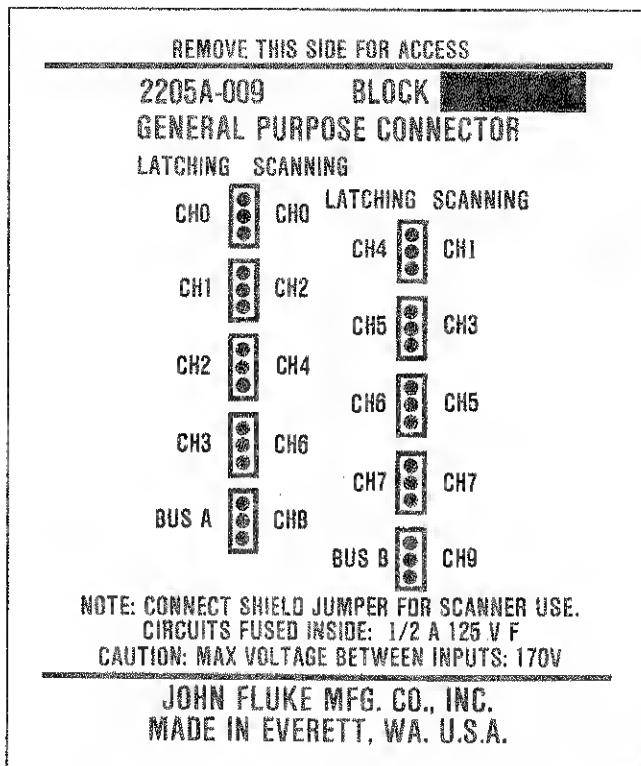


Figure 300-1. Input Connector Terminals

300-9. INSTALLATION

300-10. The General Purpose Scanner Module is installed in two parts. The scanner pcb is installed first, followed by the connector.

300-11. The General Purpose Scanner PCB can be installed in any one of the available slots in the controller mainframe. Install the scanner pcb as follows:

WARNING

REMOVE LINE POWER AND ALL OTHER HIGH VOLTAGE INPUTS TO THE MAINFRAME BEFORE STARTING THIS PROCEDURE.

1. Remove the top dust cover from the controller mainframe.

2. Remove the guard chamber cover.

CAUTION

Handle the scanner pcb by its edges to avoid contaminating the pcb with oil from the hands. The use of gloves is recommended.

3. Select the slot that includes the logical block of channels the scanner pcb is to represent. Align the scanner in the slot so that the 44-pin board edge connector is toward the rear of the unit, and the small offset board-edge connectors are toward the bottom of the unit. Push the scanner pcb straight down onto the mating connectors.

4. Install the guard chamber cover.

5. Install the top dust cover.

300-12. The General Purpose Connector and user cable assembly can be installed in any one of the controller mainframe slots which contain a scanner pcb. Install the connector as follows:

1. Unlatch the slide fasteners located on either side of the protruding enclosure at the rear of the controller mainframe.

2. Remove the enclosure from the rear panel.

3. Locate the desired slot on the rear panel and check to ensure that a scanner pcb is installed in the slot.

4. With the connector key toward the top, position the connector in the guides of the selected slot and mate it to the connector on the scanner pcb.

5. Install the retaining screw and washer that hold the connector to the controller mainframe.

6. Install the rear panel enclosure.

300-13. OPERATION

300-14. Once installed, the General Purpose Scanner Module requires no operator attention.

300-15. THEORY OF OPERATION

300-16. The General Purpose Scanner Module (Figure 300-2) is a programmable, 10-channel relay scanner designed to operate as a plug-in option in any one of the slots in a controller mainframe. Channel scanning or multiplexing is accomplished by a series of 12 form-A reed relays, 11 double-pole and 1 single-pole. Ten of the

double-pole relays serve as two-wire input channel switches to a common high/low output bus. The eleventh two-pole relay also contacts the two-wire bus; however, the function of the eleventh relay is to isolate or decouple the bus from the actual output connections. When any one of the channel relays are energized the decoupling relay is also activated to complete the two-wire input/output circuit. The single-pole relay operates in parallel with the decoupling relay. When closed, the relay connects a common channel-input shield to the output shield connection. Thus, the scanner actually provides a three-wire output (high, low, and shield).

300-17. All scanner pcbs installed in a controller mainframe and/or extender chassis receive bcd channel-select information from a 4-bit data bus (CS0 through CS3). This data is decoded on each scanner pcb into 10 separate channel commands (0-9). Each channel line is first buffered and then connected to one of the 10 channel relay coils. Even though these commands are present the relays will not be energized unless the scanner receives a block select (BSX) command. This command is actually an address or enable signal which applies voltage to the low sides of the relay coils. When the coil voltage is present the decoupling relay, the shield relay and the selected channel relay are energized. At that time the analog input data on the selected channel appears at the scanner output terminals.

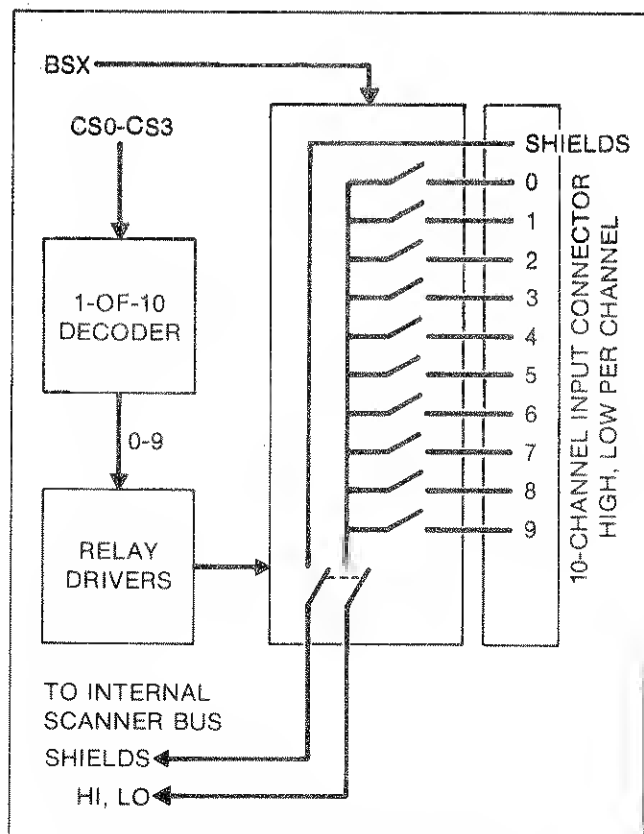


Figure 300-2. Functional Block Diagram

300-18. MAINTENANCE

300-19. Introduction

300-20. The following paragraphs cover the access and performance test information for maintaining the scanner module.

300-21. Access Information

300-22. Refer to the Installation information given earlier in this section for scanner pcb access information. Remove the rear panel input connector before attempting to remove the scanner pcb from its slot.

300-23. Performance Test

300-24. The performance test is designed to verify the overall operation for the General Purpose Scanner Module and is intended for use as an acceptance test and/or periodic maintenance check. The equipment used in the test is listed in Table 300-2. If the module fails any part of the performance test, corrective action is required. The performance test is conducted as follows:

1. Fabricate a scanner test cable as shown in Figure 300-3, using the test equipment and resistors specified in Table 300-2.

Table 300-2. Required Test Equipment

| INSTRUMENT | RECOMMENDED MODEL |
|-----------------------|---------------------------------|
| DC Voltage Calibrator | Fluke 515A |
| Mainframe | Fluke 2205A |
| Resistors (10 each) | Metal Film, 1K $\pm 1\%$, 1/4W |
| DMM | Fluke 8520A |

NOTE

Jumpers J1 thru J10 must be removed on the input connector for this test.

2. Install the General Purpose Scanner Module and the test cable in the channel 0-9 slot of the mainframe.
3. Set the calibrator output to 0V dc.
4. Connect the test cable leads to the calibrator's voltage output terminals (red to positive, black and white to negative).
5. Set the calibrator output to +1.000V dc.
6. Manually program the mainframe as follows:
 - a. Lower channel boundary to 0.

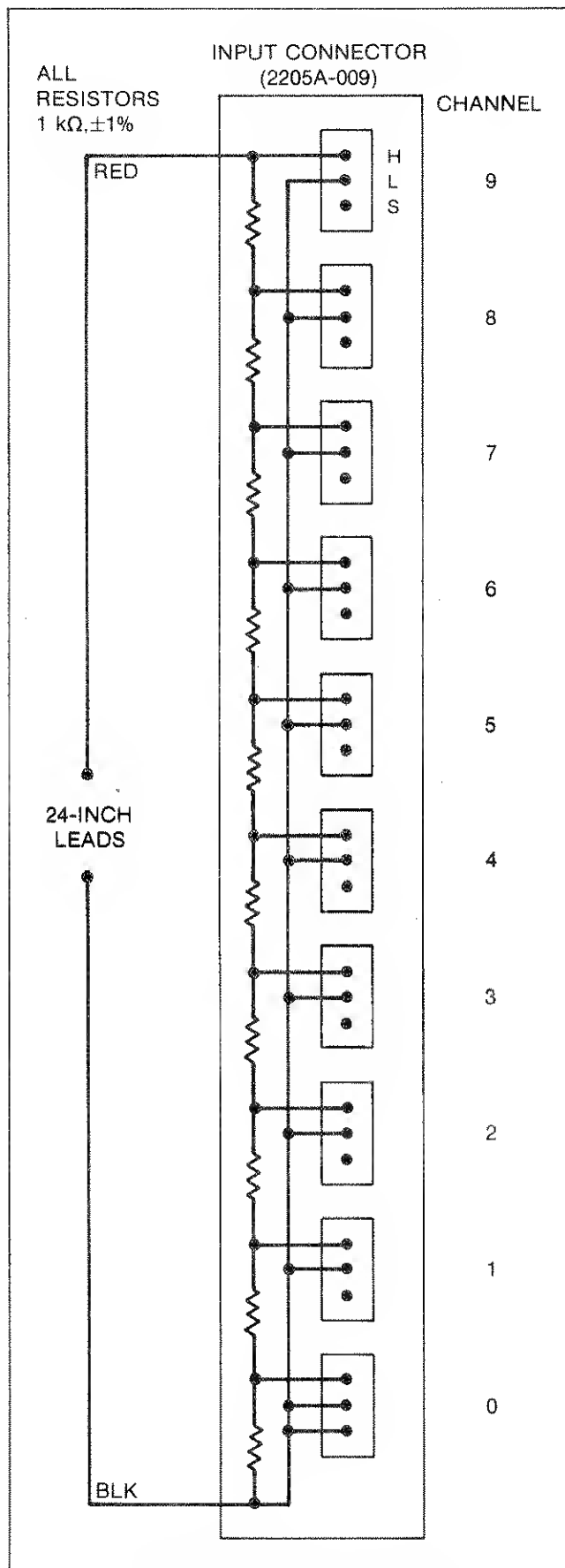


Figure 300-3. Scanner Test Cable

b. Upper channel boundary to 9.

7. Manually scan channels 0 through 9. Channels 0 should read +0.100V dc. A cumulative +0.1V increase should be observed on each of the remaining channels (channel 9 should read +1.000V dc $\pm 1\%$). Any deviation in this pattern indicates a defective pcb assembly.

300-25. LIST OF REPLACEABLE PARTS

300-26. The replaceable parts of the General Purpose Scanner Module are listed in Table 300-3. Refer to Section 6 of this manual for ordering information.

CAUTION



Indicated devices are subject to damage by static discharge.

Table 300-3. General Purpose Scanner Module

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|--|-----------------------|---------------------|--------------|------------|------------|------------------|
| -300② | GENERAL PURPOSE SCANNER MODULE FIGURE 300-4 | ORDER | BY | OPTION -300 | | | |
| -300A1② | GENERAL PURPOSE SCANNER PCB ASSEMBLY | 639799 | 89536 | 471409 | 1 | | |
| -300A2② | FUSED TERMINAL CONNECTOR SEE OPTION -200 FIGURE 200-6 | 618868 | 89536 | 618876 | REF | | |
| H1 | SCREW, PHP, 4-40 X 7/8 | 335133 | 89536 | 335133 | 2 | | |
| H2 | SCREW, PHP, 6-32 X 1/4 | 152140 | 89536 | 152140 | 8 | | |
| H3 | WASHER, FLAT, #4 | 146225 | 89536 | 146225 | 2 | | |
| MP1 | DECAL, GENERAL PURPOSE CONN. | 632133 | 89536 | 632133 | 1 | | |
| MP2 | ISOTHERMAL CONNECTOR HOUSING | 414276 | 89536 | 414276 | 2 | | |

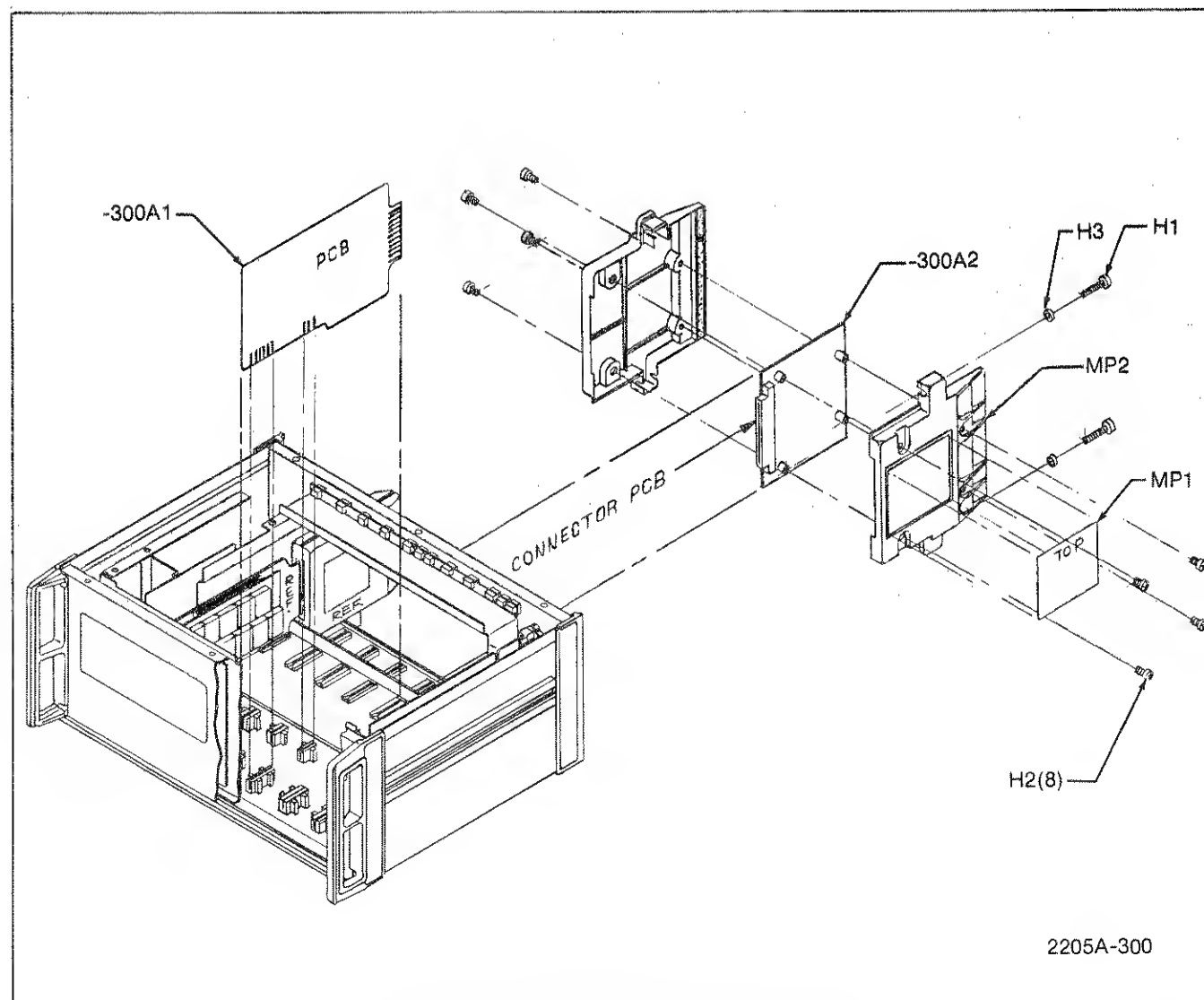
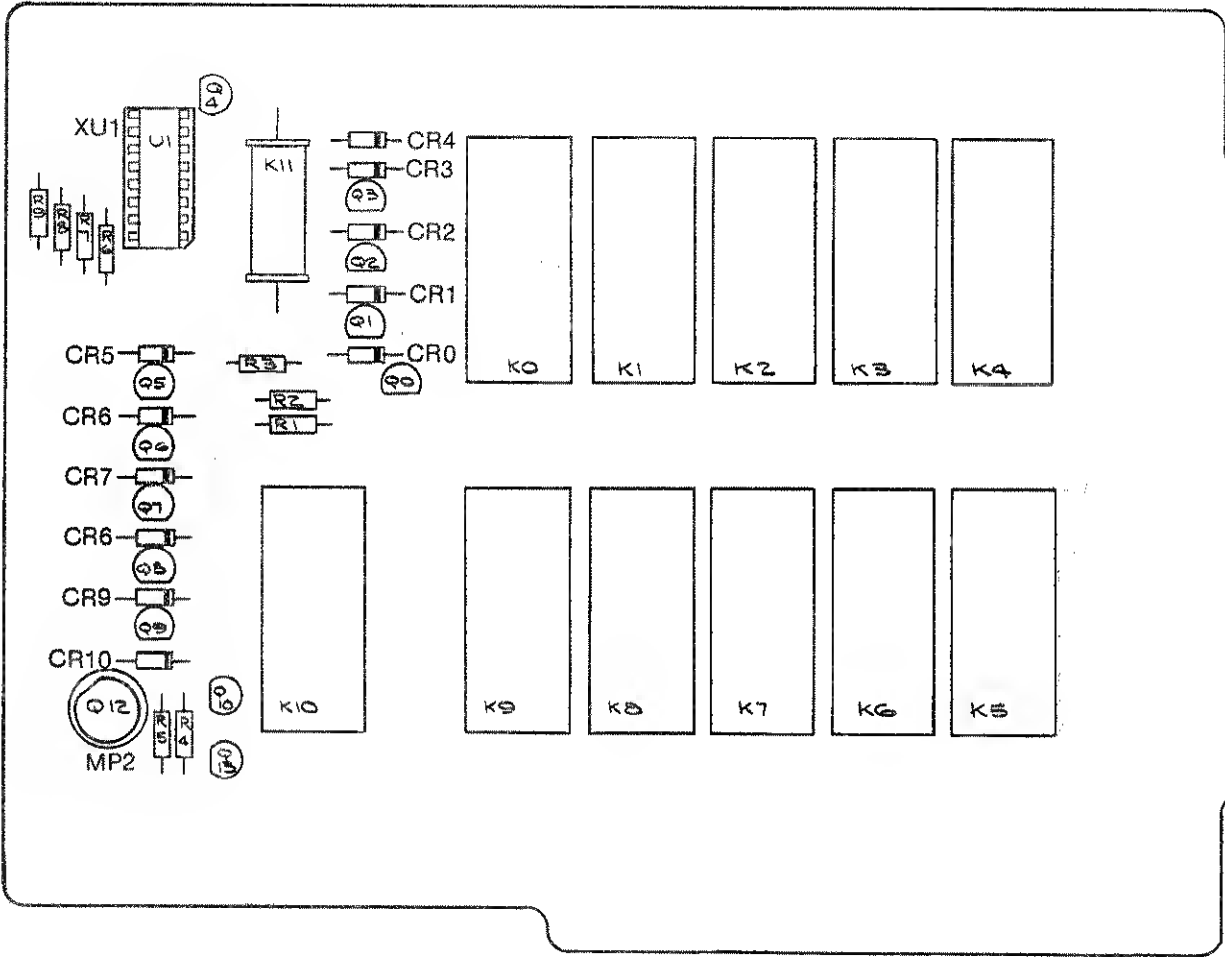


Figure 300-4. General Purpose Scanner Module

Table 300-4. General Purpose Scanner PCB Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|--|-----------------------|---------------------|----------------|------------|------------|------------------|
| -300A1② | GENERAL PURPOSE SCANNER PCB ASSEMBLY FIGURE 300-5 (2200A-4037T) | 639799 | 89536 | 471409 | REF | | |
| CR0 | DIODE, SI | 203323 | 07910 | 1N4448 | 11 | 3 | |
| CR1 | DIODE, SI | 203323 | 07910 | 1N4448 | REF | | |
| CR2 | DIODE, SI | 203323 | 07910 | 1N4448 | REF | | |
| CR3 | DIODE, SI | 203323 | 07910 | 1N4448 | REF | | |
| CR4 | DIODE, SI | 203323 | 07910 | 1N4448 | REF | | |
| CR5 | DIODE, SI | 203323 | 07910 | 1N4448 | REF | | |
| CR6 | DIODE, SI | 203323 | 07910 | 1N4448 | REF | | |
| CR7 | DIODE, SI | 203323 | 07910 | 1N4448 | REF | | |
| CR8 | DIODE, SI | 203323 | 07910 | 1N4448 | REF | | |
| CR9 | DIODE, SI | 203323 | 07910 | 1N4448 | REF | | |
| CR10 | DIODE, SI | 203323 | 07910 | 1N4448 | REF | | |
| K0 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | 11 | | |
| K1 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K2 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K3 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K4 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K5 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K6 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K7 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K8 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K9 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K10 | RELAY, DRY REED, DPST | 442921 | 21317 | 052A5300BAA | REF | | |
| K11 | COIL, REED RELAY | 269019 | 71707 | U-6-P | 1 | | |
| MP1 | DECAL, PART NO. (NOT SHOWN) | 475517 | 89536 | 475517 | 1 | | |
| MP2 | SPACER, XSTR MOUNT W/Q12 | 152207 | 07047 | 10123-DAP | 1 | | |
| Q0 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | 10 | 2 | |
| Q1 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q2 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q3 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q4 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q5 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q6 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q7 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q8 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q9 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q10 | XSTR, J-FET, N-CHANNEL | 352112 | 07910 | U26106 | 1 | 1 | |
| Q12 | XSTR, SI, NPN | 182196 | 07263 | 2N3643 | 1 | 1 | |
| Q13 | XSTR, SI, NPN | 218396 | 04713 | 2N3904 | 1 | 1 | |
| R1 | RES, MTL. FILM, 40.2 +/-1%, 1/8W | 484014 | 91637 | CMF5540R2F | 3 | | |
| R2 | RES, MTL. FILM, 40.2 +/-1%, 1/8W | 484014 | 91637 | CMF5540R2F | REF | | |
| R3 | RES, MTL. FILM, 40.2 +/-1%, 1/8W | 484014 | 91637 | CMF5540R2F | REF | | |
| R4 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | 1 | | |
| R5 | RES, DEP. CAR, 10K +/-5%, 1/4W | 348839 | 80031 | CR251-4-5P10K | 1 | | |
| R6 | RES, DEP. CAR, 100K +/-5%, 1/4W | 348920 | 80031 | CR251-4-5P100K | 4 | | |
| R7 | RES, DEP. CAR, 100K +/-5%, 1/4W | 348920 | 80031 | CR251-4-5P100K | REF | | |
| R8 | RES, DEP. CAR, 100K +/-5%, 1/4W | 348920 | 80031 | CR251-4-5P100K | REF | | |
| R9 | RES, DEP. CAR, 100K +/-5%, 1/4W | 348920 | 80031 | CR251-4-5P100K | REF | | |
| S1 | SWITCH, REED (NOT SHOWN) | 414300 | 95348 | MR5830-7 | 1 | | |
| U1② | IC, MOS, DECODER (INSTALLED IN TEST) | 407981 | 12040 | MM74C42N | 1 | 1 | |
| XU1 | SCCKET, IC, 16-PIN DIP | 276535 | 91506 | 316AG39D | 1 | | |



2200A-1637

Figure 300-5. General Purpose Scanner PCB Assembly

Option 2205A-400

Four-wire Resistance Scanner Module

400-1. INTRODUCTION

400-2. The Four-wire Resistance Scanner Module (Option 2205A-400) is a plug-in, relay scanner module designed to provide the source and sense connections for accurate 4-wire resistance measurements. The 4-wire scanner option consists of four major components; a general purpose scanner pcb for sourcing, a low level scanner pcb for sensing and two types of input connectors.

400-3. The General Purpose Scanner PCB is a plug-in, 10-channel, 2-wire relay scanner that operates as an analog data multiplexer. Switched high and low inputs are provided for each of the 10 channels and a common (unswitched) shield is provided for all 10 channels. A decoupling relay is used to isolate the high, low, and shield buses from the common output connections when a channel relay is not activated. Activating any one of the 10 channel relays also energizes the decoupling relay.

400-4. The Low Level Scanner PCB is a plug-in, 10-channel, relay scanner designed to operate as a low-level, analog data multiplexer. Each relay is a 3-wire, low-thermal-offset reed relay. Switched high, low, and shield inputs are provided for each of the 10 channels. A decoupling relay is used to isolate the high, low, and shield buses from the common output connections when a channel relay is not activated. Activating any one of the 10 channel relays also energizes the decoupling relay.

400-5. The General Purpose Connector is a connector assembly with screw-type terminals which mounts in the rear of a controller mainframe and provides electrical contact and fused protection for scanning pcbs. The connector is designed for use in fabricating a custom interface cable from external analog signals to the scanner pcbs.

400-6. The Isothermal Block Connector is an input connector assembly designed for inputting low level

thermocouple voltages and/or general purpose voltages to the Low Level Scanner PCB. Screw-type terminals provide the connections for input cables. These terminals are thermally intergrated into a isothermal block which is allowed to drift with ambient temperature. A temperature measuring circuit monitors the block temperature and returns a proportional voltage to the controller mainframe. This voltage is used by a remote controller to calculate the temperature represented by each of up to 10 thermocouple generated voltages (i.e., one per channel). The temperature measuring feature does not interfere with ordinary voltage measurements.

400-7. SPECIFICATIONS

400-8. Specifications for the Four-wire Resistance Scanner Module are listed in Table 400-1.

400-9. INPUT CONNECTIONS

400-10. All of the source connections are made at the General Purpose Connector and all of the sense connections are made at the Isothermal Block Connector. Figure 400-1 identifies the locations of the terminals for the 10 scanning channels of each connector. Access to the terminal blocks is accomplished by removing the four screws from the decal sides of the connector enclosures. The high, low, and shield connections for each channel are identified next to the terminal blocks on the general purpose connector pcb and on the decal of the isothermal connector. Only jumper J11 should be installed in the connector pcb to use the input connector with a scanner pcb.

400-11. INSTALLATION

400-12. The Four-wire Resistance Scanner Module is installed in two parts. First the scanner pcbs are installed, then the connectors are installed. The two scanner pcbs are installed in the same way. However, the Low Level Scanner PCB (sense) is installed in an even numbered slot and the General Purpose Scanner PCB (source) is installed in the next higher odd numbered slot.

Table 400-1. Option -400 Specifications

| | |
|--------------------------------------|---|
| Hardware | One each General Purpose Scanner PCB, Low Level Scanner PCB, General Purpose Connector, and Isothermal Connector. |
| Channels | 10 channels of four-wire resistance measurement. |
| Voltage Offset | Less than 1 μ V. |
| Switch Life | Greater than 10 ⁷ operations. |
| Over-Current Protection | 0.5 amp fuse in series with each source input line. 470 ohm resistor in series with each sense input line. |

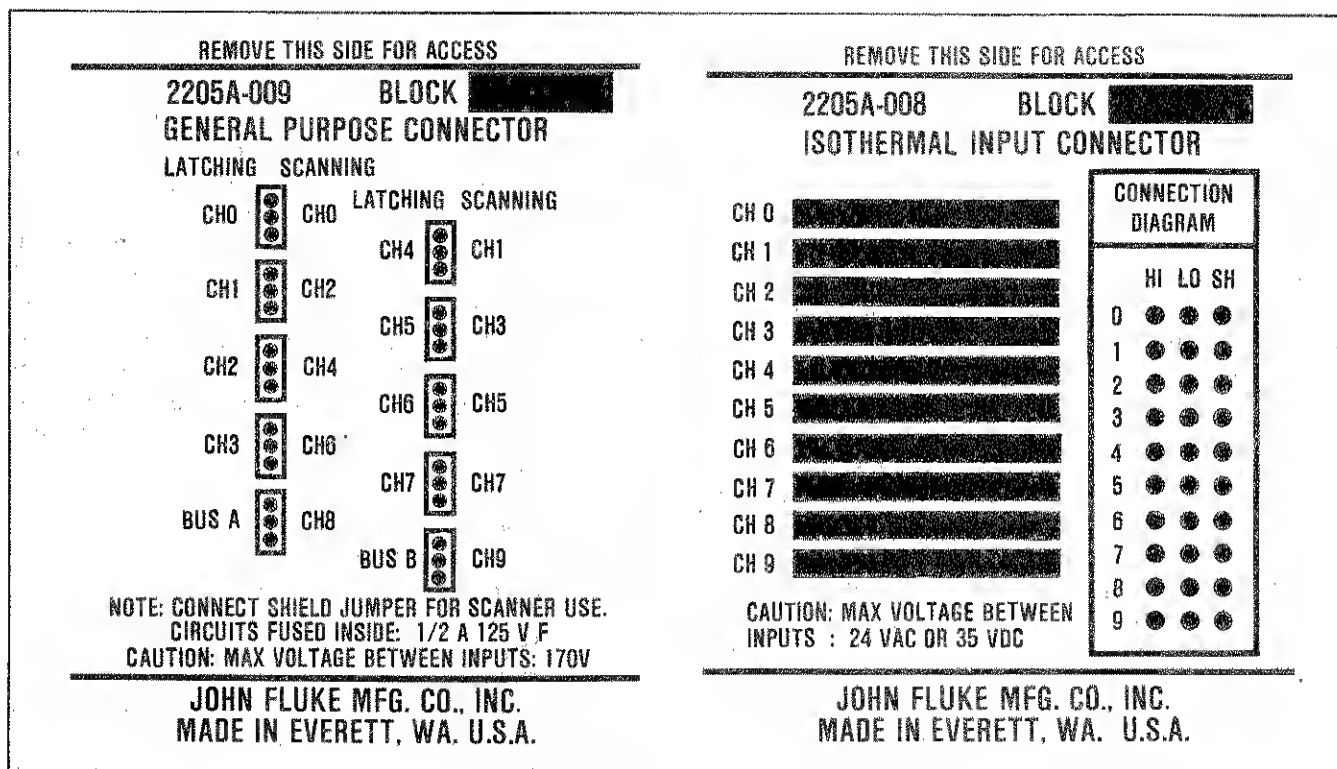


Figure 400-1. Input Connector Terminals

400-13. The scanner pcbs can be installed in any one of the available slots in the controller mainframe. Install the scanners as follows:

WARNING

REMOVE LINE POWER AND ALL OTHER HIGH VOLTAGE INPUTS TO THE MAINFRAME BEFORE STARTING THIS PROCEDURE.

1. Remove the top dust cover from the controller mainframe.
2. Set switch S1 (on the Extended Bus PCB) to the 4-wire position (toward the rear of the unit). The

controller mainframe must be in the 4-wire mode for this option to function properly.

3. Remove the guard chamber cover.

CAUTION

Handle the scanner pcbs by their edges to avoid contaminating the pcb with oil from the hands. The use of gloves is recommended.

4. Select the slot that includes the logical block of channels the scanner pcb is to represent. Align the scanner in the slot so that the 44-pin board edge connector is toward the rear of the unit, and the small offset board-edge connectors are toward the

bottom of the unit. Push the scanner pcb straight down onto the mating connectors.

5. After both of the scanner pcbs are installed, install the guard chamber cover.
6. Install the top dust cover.
7. Remove the high and low jumpers on the Analog Signal Cable (Y8076) at the controller mainframe end.

400-14. Use the following procedure to install the connectors on the appropriate scanner pcbs:

1. Unlatch the slide fasteners located on either side of the protruding enclosure at the rear of the controller mainframe.
2. Remove the enclosure from the rear panel.
3. Locate the desired slot on the rear panel and check to ensure that the proper scanner pcb is installed in the slot.

NOTE

Be sure to mate the connector with source inputs to the General Purpose PCB (odd numbered slot) and the connector with sense inputs to the Low Level PCB (even numbered slot).

4. With the connector key toward the top, position each connector in the guides of the selected slot and mate it to the connector on the scanner pcb.
5. Install the retaining screws and washers that hold the connectors to the controller mainframe.
6. After both of the input connectors are installed, install the rear panel enclosure.

400-15. OPERATION

400-16. Once installed, the Four-wire Resistance Scanner Module requires no operator attention.

400-17. THEORY OF OPERATION

400-18. The Four-wire Resistance Scanner Module (Figure 400-2) is a scanner module made up of two scanner pcbs and two input connectors. The module is designed to provide all the source and sense connections to operate as a 10 channel 4-wire resistance measurement scanner. A general purpose scanner pcb (in an odd numbered slot) provides the 10 source lines and a low level scanner pcb (in an even numbered slot) provides the 10 sense lines.

400-19. The General Purpose Scanner PCB is a programmable, 10-channel relay scanner designed to provide the source lines for 4-wire resistance measurements. Channel scanning or multiplexing is accomplished by a series of 12 form-A reed relays: 11 double-pole and one single-pole. Ten of the double-pole relays serve as two-wire input channel switches to a common high/low output bus. The eleventh two-pole relay also contacts the two-wire bus; however, the function of the eleventh relay is to isolate or decouple the bus from the actual output connections. When any one of the channel relays is energized, the decoupling relay is also activated to complete the two-wire input/output circuit. The single-pole relay operates in parallel with the decoupling relay. When closed, the single pole relay connects a common channel-input shield to the output shield connection to provide a three-wire output (Bus 1 - high, low and shield).

400-20. The Low Level Scanner PCB is a programmable, 10-channel relay scanner designed to provide the sense lines for 4-wire resistance measurements. Channel scanning or multiplexing is accomplished by a series of 11 three-pole, form-A, reed relays. Ten of the relays serve as three-wire input channel switches to a common (high, low and shield) output bus. The eleventh relay also contacts the three-wire output bus. However, the function of the eleventh relay is to isolate or decouple the bus from the actual output connections. When any one of the channel relays are energized the decoupling relay is also activated to complete the three-wire output (Bus 2 - high, low and shield).

400-21. All scanner pcbs installed in a controller mainframe and/or extender chassis receive bcd channel-select information from a 4-bit data bus (CS0 through CS3). The 2-/4-wire switch (on the Extended Bus PCB) puts the controller mainframe in 4-wire operation so both scanner pcbs receive the same channel-select data. This data is decoded on each scanner pcb into 10 separate channel commands (0-9). Each channel line is first buffered and then connected to one of the 10 channel relay coils. Even though these commands are present the relays will not be energized unless the module receives an even numbered block select (BSX) command. This command is actually an address or enable signal which applies voltage to the low side of the relay coils. When the coil voltage is present the decoupling relay, the shield relay and the selected channel relay are energized. At that time the 4-wire circuit is complete from the source line (Bus 2) to the selected measurement channel and back to the sense line (Bus 1).

400-22. MAINTENANCE

400-23. Introduction

400-24. The following paragraphs cover the access and performance test information for maintaining the switch module.

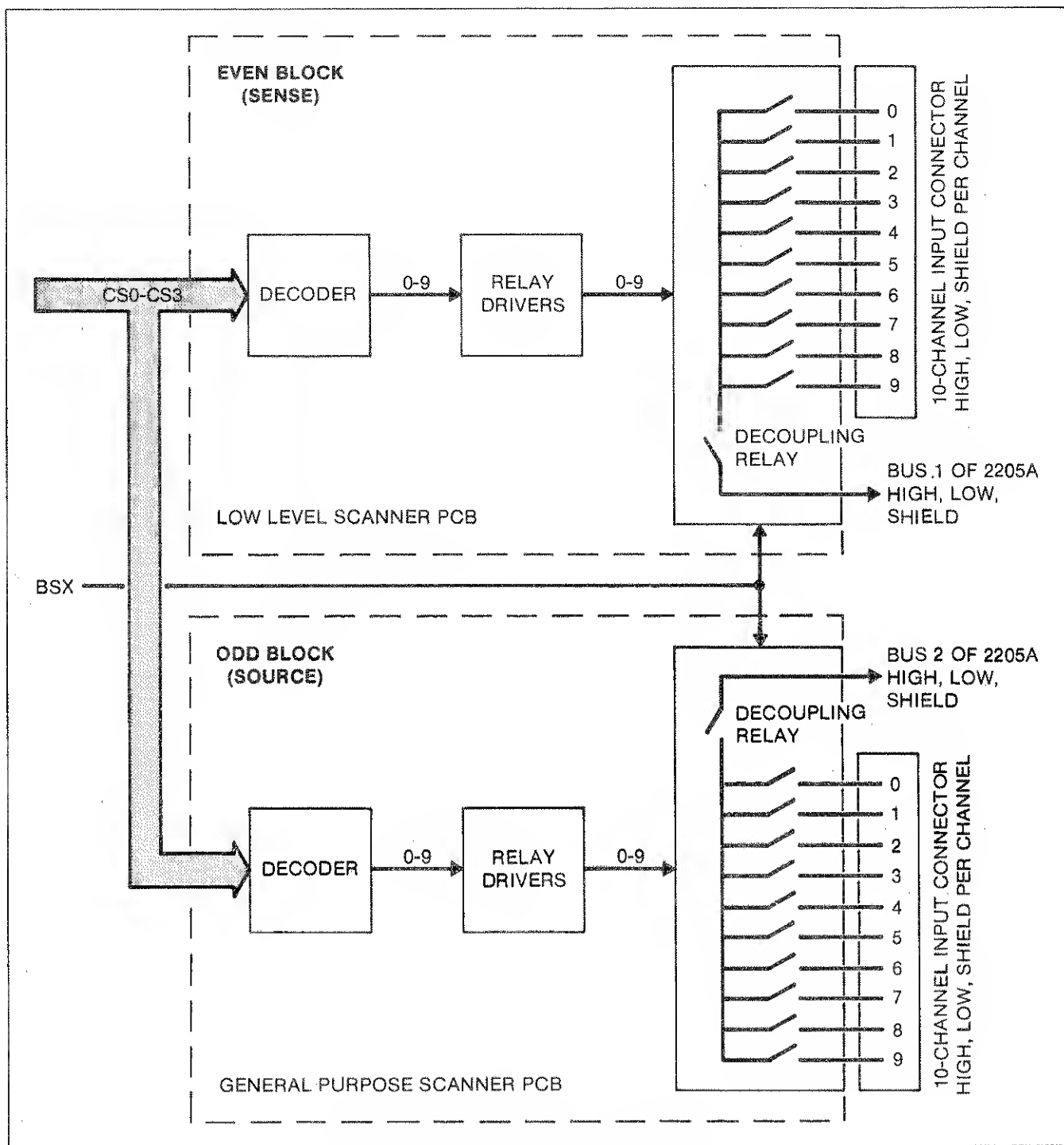


Figure 400-2. Functional Block Diagram

400-25. Access Information

400-26. Refer to the Installation information given earlier in this section for scanner pcb access information. Remove the rear panel input connector before attempting to remove a scanner pch from its slot.

400-27. Performance Test

400-28. The performance test is designed to verify the

overall operation for the Four-wire Resistance Scanner Module and is intended for use as an acceptance test and/or periodic maintenance check. The following procedure is used to test both the Low Level and the General PurposeScanner PCBs. The equipment used in the test is listed in Table 400-2. If either of the scanner pcbs fail any part of the performance test, corrective action is required. The performance test is conducted as follows:

1. Fabricate a scanner test cable as shown in Figure 400-3 using the resistors specified in Table 400-2.

NOTE

Jumpers J1 thru J10 must be cut and jumper J11 must be installed on the General Purpose Connector for this test.

2. Install the Low Level Scanner PCB in slot 0 and the General Purpose PCB in slot 1.

3. Install the input connectors and test cable.

4. Set the DMM to the 10 ohm range.

5. Connect the DMM to the controller mainframe through the Analog Signal Cable (Bus 1 to sense; Bus 2 to source).

6. Manually program the controller mainframe as follows:

a. Lower channel boundary to 0.

b. Upper channel boundary to 9.

7. Manually scan channels 0 through 9. All of the channels should read 10 ohms $\pm 1\%$. Any deviation in this pattern indicates a defective pcb assembly.

Table 400-2. Required Test Equipment

| INSTRUMENT | RECOMMENDED MODEL |
|------------------------------|-------------------------------------|
| DMM (with 4-wire resistance) | Fluke 8502A |
| Mainframe | Fluke 2205A |
| Resistors (10 each) | Metal Film, 10 Ω , $\pm 1\%$ |

400-29. LIST OF REPLACEABLE PARTS

400-30. The replaceable parts of the Four-wire Resistance Scanner Module Assembly are listed in Table 400-3. Refer to Section 6 of this manual for ordering information.

CAUTION



Indicated devices are subject to damage by static discharge.

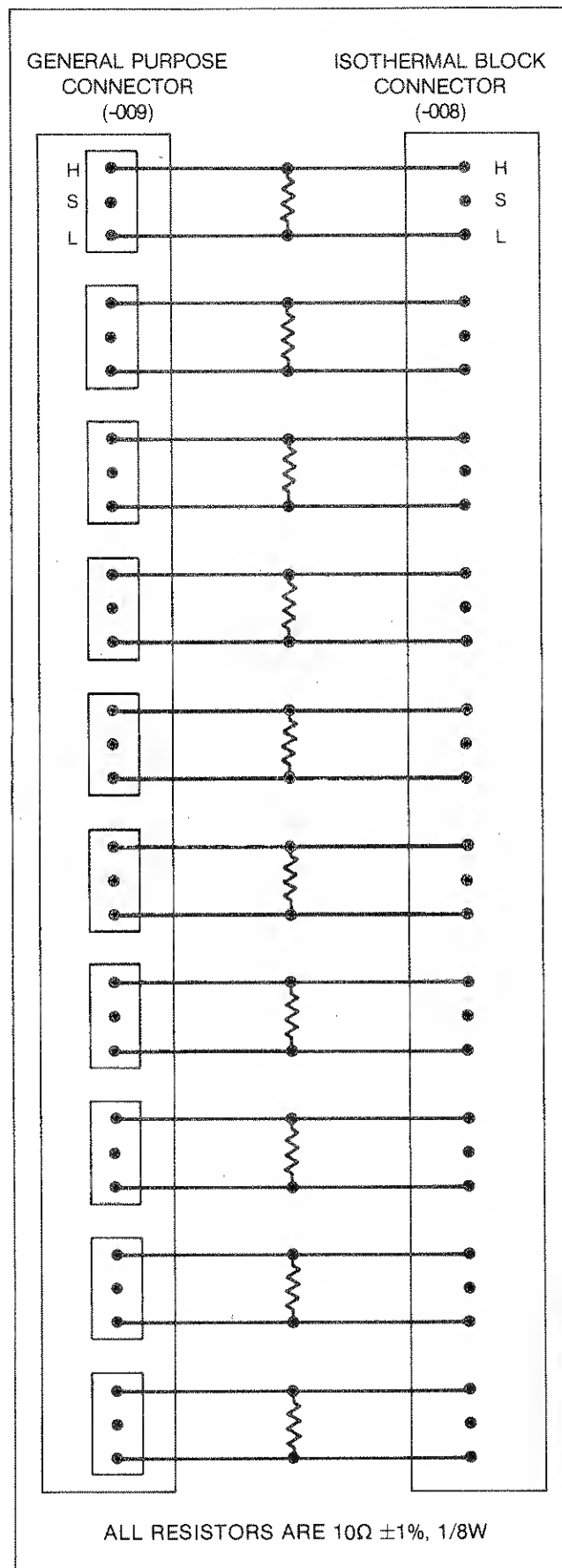


Figure 400-3. Scanner Test Cable

Table 400-3. Four-wire Resistance Scanner

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | NOTE |
|------------|--|-----------------------|---------------------|--------------|------------|------------|------|
| -400② | FOUR-WIRE RESISTANCE SCANNER FIGURE 400-4 | ORDER | BY | OPTION -400 | | | |
| | GENERAL PURPOSE SCANNER PCB ASSY SEE OPTION -300 FIGURE 300-5 | 639779 | 89536 | 471409 | | REF | |
| | FUSED TERMINAL CONNECTOR SEE OPTION -200 FIGURE 200-6 | 618868 | 89536 | 618868 | | REF | |
| | LOW LEVEL SCANNER PCB ASSEMBLY SEE OPTION -600 FIGURE 600-5 | 409607 | 89536 | 409607 | | REF | |
| | ISOTHERMAL INPUT CONNECTOR SEE OPTION -600 FIGURE 600-6 | 409573 | 89536 | 409573 | | REF | |
| H1 | SCREW, PHP, S/S, 4-40 X 7/8 | 335133 | 89536 | 335133 | 4 | | |
| H2 | SCREW, PHP, 6-32 X 1/4 | 152140 | 89536 | 152140 | 16 | | |
| H3 | WASHER, FLAT, #4 | 146225 | 89536 | 146225 | 4 | | |
| MP1 | DECAL, GENERAL PURPOSE CONN. | 632133 | 89536 | 632133 | 1 | | |
| MP2 | DECAL, ISOTHERMAL INPUT CONN. | 629899 | 89536 | 629899 | 1 | | |
| MP3 | ISOTHERMAL CONNECTOR HOUSING | 414276 | 89536 | 414276 | 4 | | |

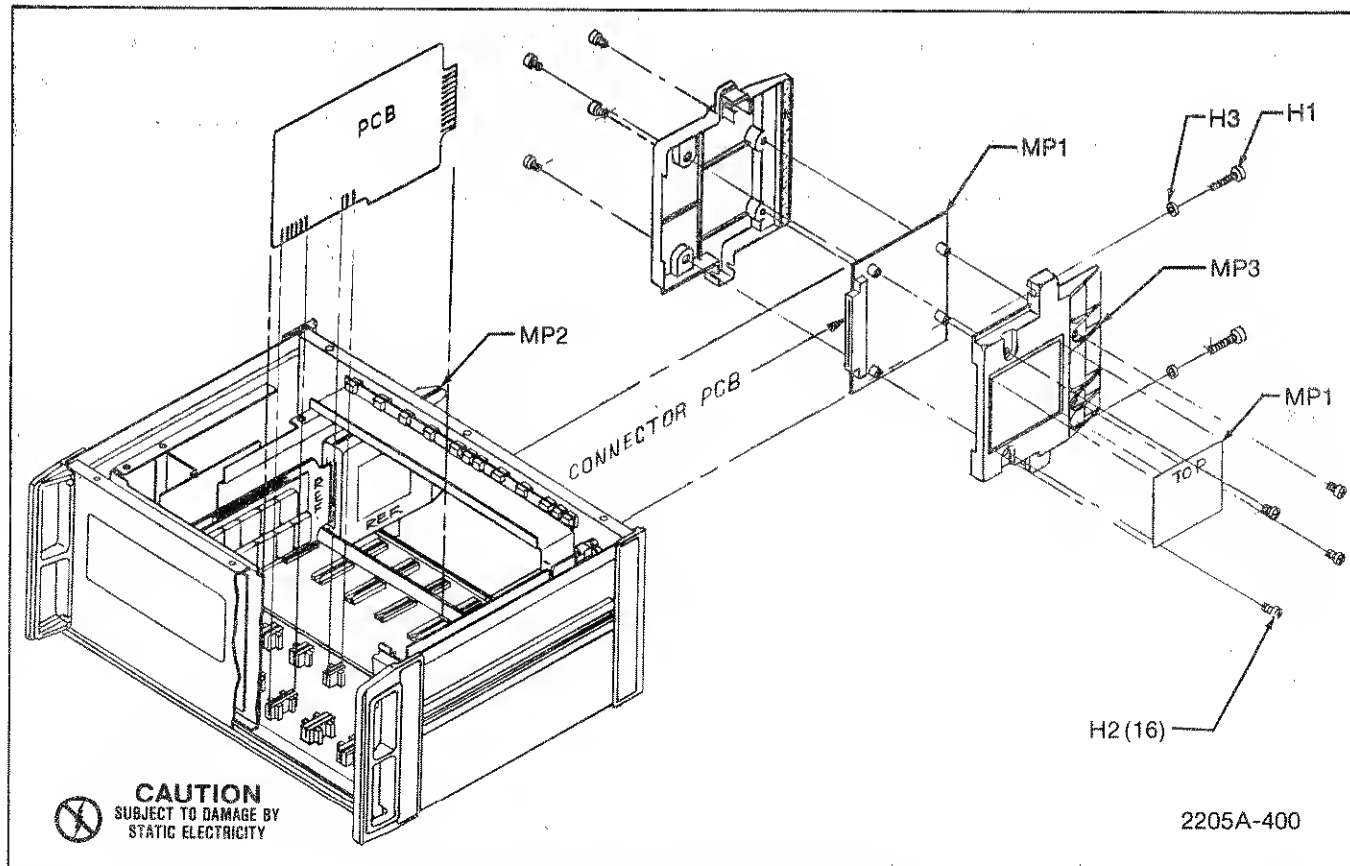


Figure 400-4. Four-wire Resistance Scanner

Option 2205A-600 Low Level Scanner Module

600-1. INTRODUCTION

600-2. The Low Level Scanner Module (Option 2205A-600) is a plug-in relay scanner module designed for use with thermocouples or other low level analog signal sources. The module consists of a Low Level Scanner PCB and an Isothermal Block Connector.

600-3. The Low Level Scanner PCB is a plug-in 10-channel, relay scanner that operates as a low-level analog data multiplexer. Each relay is a 3-wire, low-thermal-offset reed relay. Switched high, low, and shield inputs are provided for each of the 10 channels. A decoupling relay is used to isolate the high, low, and shield buses from the common output connections when a channel relay is not activated. Activating any one of the 10 channel relays also energizes the decoupling relay.

600-4. The Isothermal Block Connector is an input connector assembly designed for inputting low level thermocouple voltages and/or general purpose voltages to the Low Level Scanner PCB. Screw-type terminals provide the connections for input cables. These terminals are thermally integrated into an isothermal block which is allowed to drift with ambient temperature. A temperature measuring circuit monitors the block temperature and returns a proportional voltage to the mainframe. This voltage is used by a system controller to calculate the temperature represented by each of up to 10 thermocouple generated voltages (i.e., one per channel). The temperature measuring feature does not interfere with ordinary voltage measurements.

600-5. SPECIFICATIONS

600-6. The specifications for the Low Level Scanner Module are listed in Table 600-1.

Table 600-1. Option -600 Specifications

| | |
|---|---|
| Hardware | One each Low Level Scanner PCB and Isothermal Block Connector. |
| Channels | Ten 3-wire channels using low thermal offset reed relays. High, low, and shield are switched. Contacts are brought out to an isothermal block input connector with screw-type terminals and monitored reference junction temperature. |
| Voltage Offset | Less than 1 μ V. |
| Switch Life | Greater than 10^7 operations. |
| Contact Current | 15 mA maximum. |
| Input Voltage Limit* | 24V ac or 35V dc. |
| Common Mode Voltage Limit (Voltage between chassis and any input) | 24V ac or 35V dc provided the input voltage limit is not exceeded. |
| Over Current Protection | 100 ohm resistor in series with each input line. |

* Maximum voltage between any two terminals in the system including normal mode as well as common mode voltages.

600-7. INPUT CONNECTIONS

600-8. The analog interface is completed through an Isothermal Block Connector with screw-type terminals. Figure 600-1 identifies the location of the high, low, and shield input terminals for each of the 10 channels. Access to the terminals is accomplished by removing the four cover screws from the decal side of the connector enclosure. As input connections are completed, use the space provided on the connector decal to identify the connector's logical block assignment and each of its input signals.

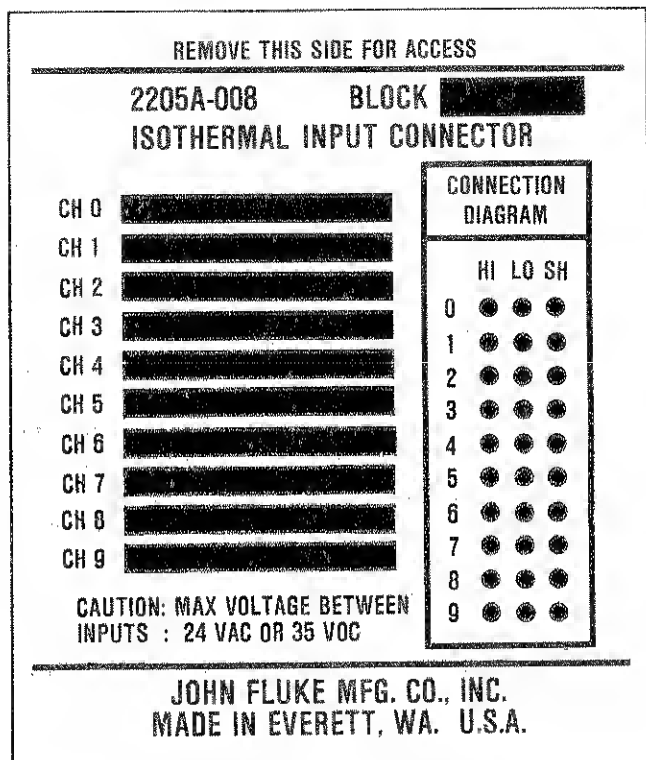


Figure 600-1. Input Connector Terminals

600-9. INSTALLATION

600-10. The Low Level Scanner Module is installed in two parts. First the Low Level Scanner PCB is installed, then the Isothermal Block Connector is installed.

600-11. The Low Level Scanner PCB can be installed in any slot available in the controller mainframe. Install the scanner pcb as follows:

WARNING

REMOVE LINE POWER AND ALL OTHER HIGH VOLTAGE INPUTS TO THE MAINFRAME BEFORE STARTING THIS PROCEDURE.

1. Remove the top dust cover from the controller mainframe.

2. Remove the guard chamber cover.

CAUTION

Handle the scanner pcb by its edges to avoid contaminating the pcb with oil from the hands. The use of gloves is recommended.

3. Select the slot that includes the logical block of channels the scanner pcb is to represent. Align the scanner in the slot so that the 44-pin board-edge connector is toward the rear of the unit, and the small offset board-edge connectors are toward the bottom of the unit. Push the scanner pcb straight down onto the mating connectors.

4. Install the guard chamber cover.

5. Install the top dust cover.

600-12. The Isothermal Block Connector can be installed in any one of the controller mainframe slots which contain a relay scanner pcb. Install the connector as follows:

1. Unlatch the slide fasteners located on either side of the protruding enclosure at the rear of the controller mainframe.

2. Remove the enclosure from the rear panel.

3. Locate the desired slot on the rear panel and check to ensure that a scanner pcb is installed in the slot.

4. With the connector key toward the top, position the connector in the guides of the selected slot and mate it with the connector on the scanner pcb.

5. Install the retaining screw and washer that hold the input connector to the controller mainframe.

6. Install the rear panel enclosure.

600-13. OPERATION

600-14. Once installed, the Low Level Scanner Module requires no operator attention.

600-15. THEORY OF OPERATION

600-16. The Low Level Scanner Module (Figure 600-2) is a 10-channel relay multiplexer that provides the selection of input analog signals to the output bus of the mainframe. An Isothermal Block Connector provides the reference junction temperature for use with thermocouples.

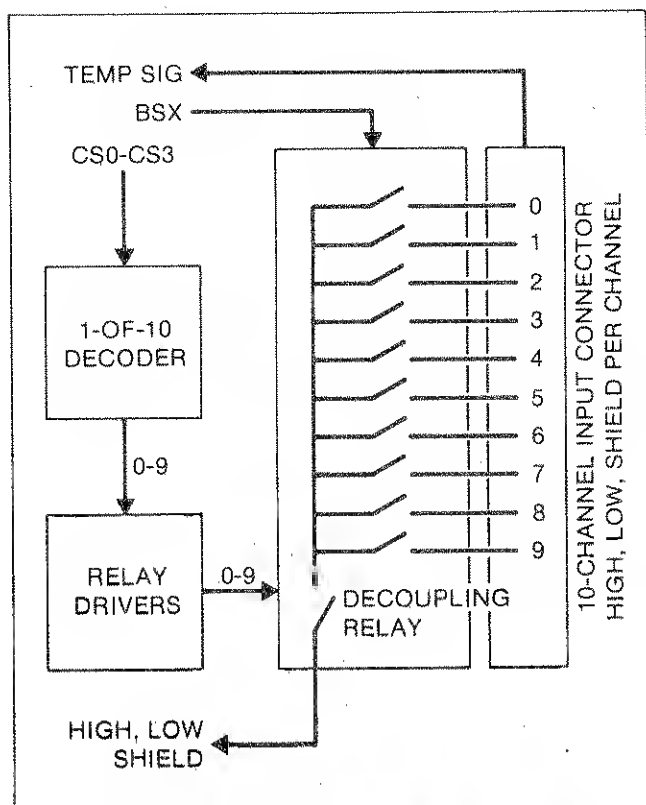


Figure 600-2. Functional Block Diagram

600-17. The Low Level Scanner PCB is a programmable 10-channel relay scanner designed to operate as a plug-in option in any one of the slots in a controller mainframe. Channel scanning or multiplexing is accomplished by a series of 11 three-pole, form-A, reed relays. Ten of the relays serve as three-wire input channel switches to a common (high/low/shield) output bus. The eleventh relay also contacts the three-wire output bus; however, the function of the eleventh relay is to isolate or decouple the bus from the actual output connections. When any one of the channel relays is energized the decoupling relay is also activated to complete the three-wire input/output circuit.

600-18. All scanner pcbs installed in the controller mainframe and/or extender chassis receive bcd channel-select information in parallel from a 4-bit data bus (CS0 through CS3). This data is decoded on each scanner pcb into 10 separate channel commands (0-9). Each command line is first buffered and then connected to one of the 10 channel relay coils. Even though these commands are present, the relays will not be energized unless the scanner pcb receives a block select (BSX) command. This command is actually an address or enable signal which applies a control command to the low side of the relay coils. When this signal is present, the decoupling relay and the selected channel relay are energized. At that time the analog input data on the selected channel appears at the scanner output terminals.

600-19. The Isothermal Block Connector provides the connections necessary for supplying voltage and/or thermocouple temperature inputs to any of the 10 scanner channels. Input connections are in the form of 10 sets of 3-screw terminals (high, low, and shield). The input signals at any given channel are measured in terms of voltage. When thermocouple inputs are used, temperature is calculated using both the thermocouple voltage and the reference voltage. The voltage of the junction is normally 539.2 mV at 25°C. To convert the reference junction voltage to a temperature use the formula:

$$T (^{\circ}\text{C}) = 250.17 - (417.54 \times V_{\text{ref}})$$

600-20. Assuming that a thermocouple is providing the input signal to a channel when the temperature function is programed, the isothermal connector provides a remote measurement device with information necessary to compute the actual temperature at the thermocouple probe. This information includes the thermocouple voltage at the input terminals and a voltage indicative of the thermocouple input terminal temperature. The thermocouple input voltage is a direct result of the probe temperature versus the input terminal temperature. The input terminal temperature is measured by a separate sensing circuit and is electrically isolated from the thermocouple connections.

600-21. The mass and temperature response of the isothermal block is such that the input terminal temperature and the semiconductor sensor are held to within less than +0.05°C of each other. Actual block temperature is allowed to vary with ambient temperature.

600-22. When a relay scanner is addressed, the temperature sensing circuit provides the remote measurement device with a voltage proportional to the temperature of the isothermal block. This method of compensating a thermocouple reference junction is accurate over a temperature range of 0 to 50°C.

600-23. MAINTENANCE

600-24. Introduction

600-25. The following paragraphs cover the access and performance test information for maintaining the module.

600-26. Access Information

600-27. Refer to the installation information given earlier for scanner pcb access information. Remove the input connector before attempting to remove the scanner pcb from its slot.

600-28. Performance Test

600-29. The performance test is designed to verify the overall operation of the Low Level Scanner Module and is intended for use as an acceptance test and/or periodic maintenance check. The equipment used in the test is

specified in Table 600-2. If the scanner pcb fails any part of the performance test, corrective action is required. The performance test is conducted as follows:

1. Fabricate a scanner test cable as shown in Figure 600-3 using the resistors specified in Table 600-2.
2. Install the Low Level Scanner Module and the test cable in the channel 0-9 slot of the controller mainframe.
3. Set the calibrator output to 0V dc.
4. Connect the test cable leads to the calibrator's voltage output terminals (red to positive, black and white to negative).
5. Set the calibrator output to +1.000V dc.
6. Manually program the mainframe as follows:
 - a. Lower channel boundary to 0.
 - b. Upper channel boundary to 9.
7. Manually scan channels 0 through 9. Channels 0 should read +0.1V dc. A cumulative +0.1V increase should be observed on each of the remaining channels (channel 9 should read +1.000V dc $\pm 1\%$). Any deviation in this pattern indicates a defective pcb assembly.

Table 600-2. Required Test Equipment

| INSTRUMENT | RECOMMENDED MODEL |
|-----------------------|---------------------------------|
| DC Voltage Calibrator | Fluke 515A |
| Mainframe | Fluke 2205A |
| Resistors (10 each) | Metal Film, 1K $\pm 1\%$, 1/4W |
| DMM | Fluke 8520A |

600-30. LIST OF REPLACEABLE PARTS

600-31. The replaceable parts of the Low Level Scanner Module are listed in Table 600-3. Refer to Section 6 of this manual for ordering information.

CAUTION



Indicated devices are subject to damage by static discharge.

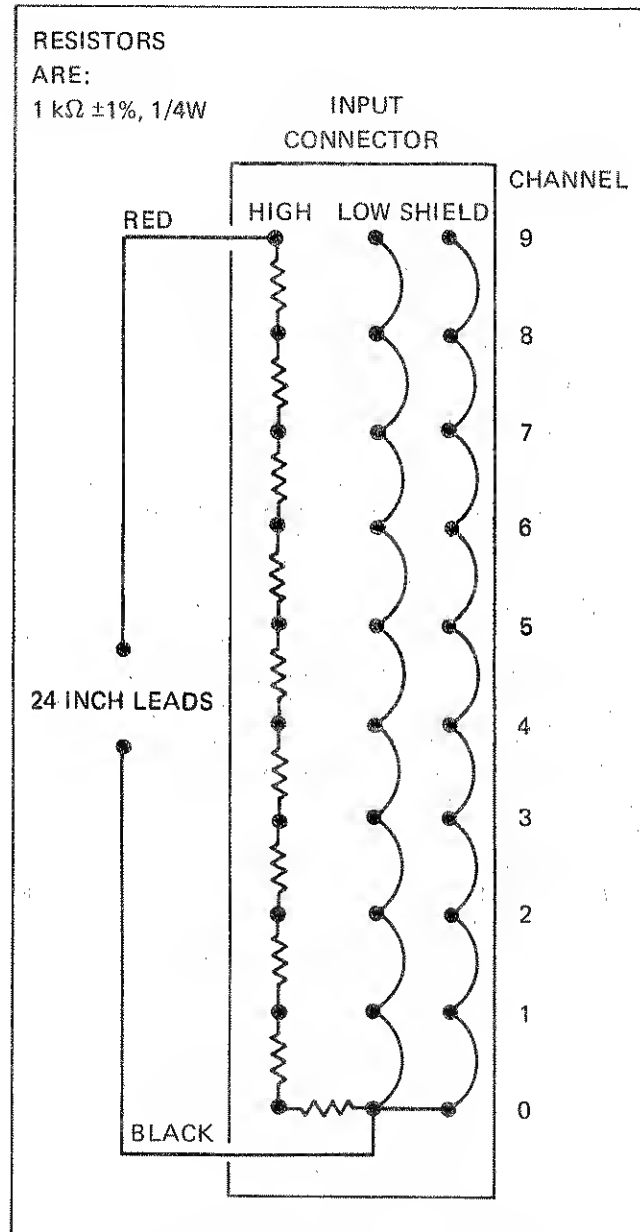


Figure 600-3. Scanner Test Cable

Table 600-3. Thermocouple Scanner Module

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|--|-----------------------|---------------------|--------------|------------|------------|------------------|
| -600② | THERMOCOUPLE SCANNING MODULE (SEE FIGURE 600-4) | ORDER | BY | OPTION -600 | | | |
| -600A1② | LOW LEVEL SCANNER PCB ASSEMBLY | 639740 | 89536 | 409607 | 1 | | |
| -600A2 | ISOTHERMAL INPUT CONNECTOR | 409573 | 89536 | 409573 | 1 | | |
| H1 | SCREW, PHP, 4-40 X 7/8 | 335133 | 89536 | 335133 | 2 | | |
| H2 | SCREW, PHP, 6-32 X 1/4 | 152140 | 89536 | 152140 | 8 | | |
| H3 | WASHER, FLAT, #4 | 146225 | 89536 | 146225 | 2 | | |
| MP1 | DECAL, ISOTHERMAL INPUT CONN. | 629899 | 89536 | 629899 | 1 | | |
| MP2 | ISOTHERMAL CONNECTOR HOUSING | 414276 | 89536 | 414276 | 2 | | |

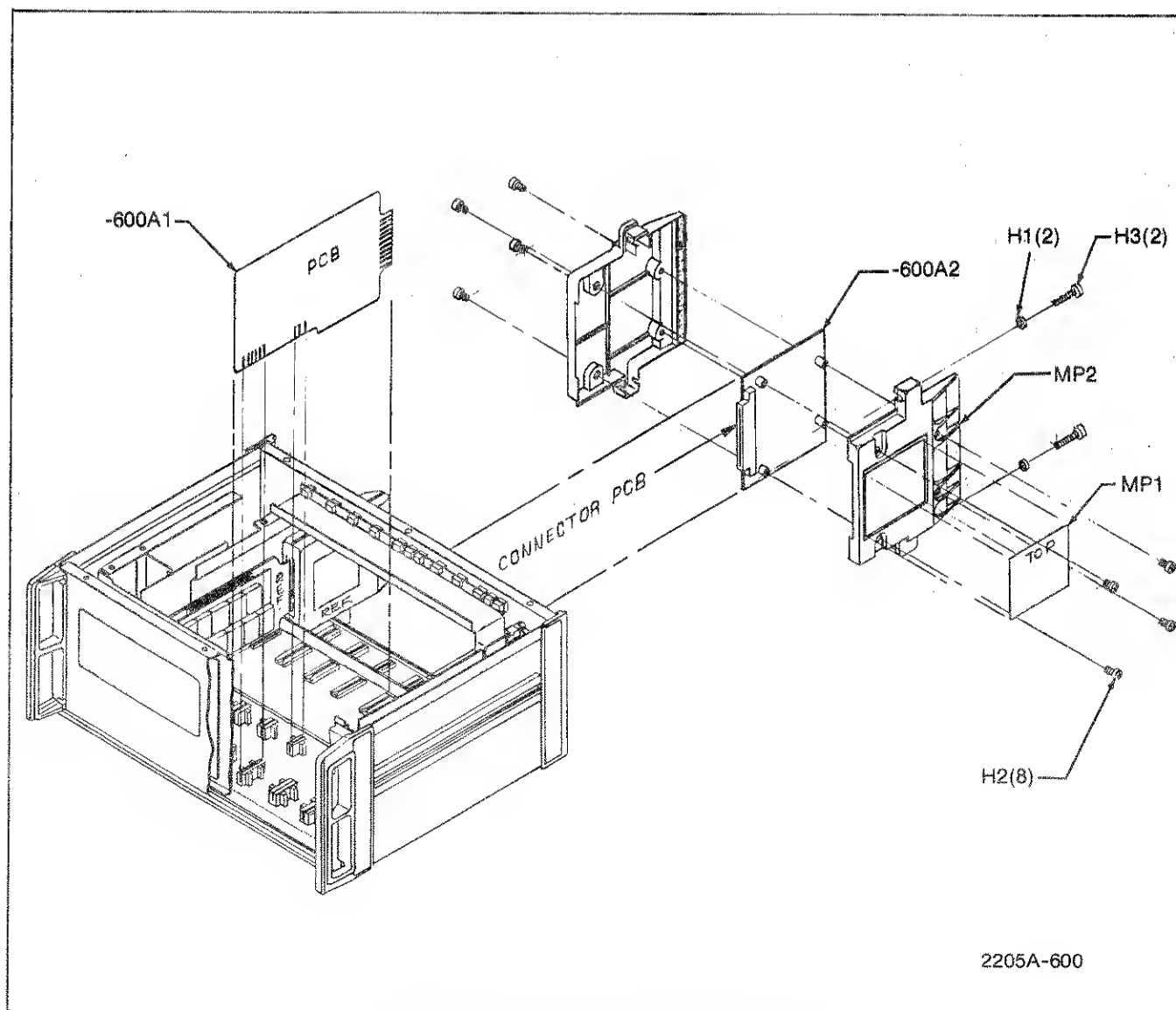


Figure 600-4. Thermocouple Scanner Module

Table 600-4. Low Level Scanner PCB Assembly

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | NO TE |
|------------|--|-----------------------|---------------------|------------------|------------|------------|----------|
| -600A10 | LOW LEVEL SCANNER PCB ASSEMBLY FIGURE 600-5 (2200A-4029T) | 639740 | 89536 | 409607 | REF | | |
| CR0 | DIODE, HI-SPEED SWITCHING | 203323 | 07910 | 1N4448 | 11 | 3 | |
| CR1 | DIODE, HI-SPEED SWITCHING | 203323 | 07910 | 1N4448 | REF | | |
| CR2 | DIODE, HI-SPEED SWITCHING | 203323 | 07910 | 1N4448 | REF | | |
| CR3 | DIODE, HI-SPEED SWITCHING | 203323 | 07910 | 1N4448 | REF | | |
| CR4 | DIODE, HI-SPEED SWITCHING | 203323 | 07910 | 1N4448 | REF | | |
| CR5 | DIODE, HI-SPEED SWITCHING | 203323 | 07910 | 1N4448 | REF | | |
| CR6 | DIODE, HI-SPEED SWITCHING | 203323 | 07910 | 1N4448 | REF | | |
| CR7 | DIODE, HI-SPEED SWITCHING | 203323 | 07910 | 1N4448 | REF | | |
| CR8 | DIODE, HI-SPEED SWITCHING | 203323 | 07910 | 1N4448 | REF | | |
| CR9 | DIODE, HI-SPEED SWITCHING | 203323 | 07910 | 1N4448 | REF | | |
| CR10 | DIODE, HI-SPEED SWITCHING | 203323 | 07910 | 1N4448 | REF | | |
| H1 | SCREW, S/S, 6-32 X 3/8 | 572537 | 89536 | 572537 | 5 | | |
| J14 | CONNECTOR, MALE, 12-PIN | 380683 | 27264 | A2402-09-64-1121 | 1 | | |
| KO-K10 | RELAY COIL ASSEMBLY | | | | | | |
| KO-K11 | COIL, REED RELAY, 135 +/-10%, 5V | 380709 | 71707 | E8206 | 11 | | |
| KO-K12 | CORE, METAL, RELAY COIL | 380451 | 89536 | 380451 | 11 | | |
| MP1 | SHIELD, BOTTOM | 526830 | 89536 | 526830 | 1 | | |
| MP2 | SHIELD, TOP | 526863 | 89536 | 526863 | 1 | | |
| MP3 | SPACER, SHIELD, BOTTOM | 412320 | 89536 | 412320 | 1 | | |
| MP4 | SPACER, SHIELD, TOP | 412312 | 89536 | 412312 | 1 | | |
| MP5 | SPACER, XSTR MOUNT W/Q11 | 152207 | 07047 | 10123-DAP | 1 | | |
| MP6 | COIL PCB | 409334 | 89536 | 409334 | 1 | | |
| MP7 | 1 MICROVOLT REED PCB | 409276 | 89536 | 409276 | 1 | | |
| P14 | CONNECTOR, FEMALE, 12-PIN | 380691 | 27264 | 2145B09-52-3122 | 1 | | |
| Q0 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | 10 | 2 | |
| Q1 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q2 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q3 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q4 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q5 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q6 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q7 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q8 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q9 | XSTR, SI, PNP | 195974 | 04713 | 2N3906 | REF | | |
| Q10 | XSTR, SI, NPN | 218396 | 04713 | 2N3904 | 1 | 1 | |
| Q11 | XSTR, SI, NPN | 182196 | 07263 | 2N3643 | 1 | 1 | |
| Q12 | XSTR, FET, N-CHANNEL | 429977 | 89536 | 429977 | 1 | 1 | |
| R0 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | 31 | | |
| R1 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R2 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R3 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R4 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R5 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R6 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R7 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R8 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R9 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |

Table 600-4. Low Level Scanner PCB Assembly (cont)

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|---------------------------------|-----------------------|---------------------|----------------|------------|------------|------------------|
| R10 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R11 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R12 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R13 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R14 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R15 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R16 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R17 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R18 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R19 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R20 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R21 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R22 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R23 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R24 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R25 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R26 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R27 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R28 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R29 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| R33 | RES, COMP, 10K +/-5%, 1/2W | 109165 | 01121 | EB1035 | 1 | | |
| R34 | RES, DEP. CAR, 470 +/-5%, 1/4W | 343434 | 80031 | CR251-4-5P470E | REF | | |
| S0 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | 33 | | |
| S1 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S2 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S3 | SWITCH, DRY REED, SPST, 3W, 40V | 380717 | 95348 | MR-0780-3 | REF | | |
| S4 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S5 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S6 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S7 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S8 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S9 | SWITCH, DRY REED, SPST, 3W, 40V | 380717 | 95348 | MR-0780-3 | REF | | |
| S10 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S11 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S12 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S13 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S14 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S15 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S16 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S17 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S18 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S19 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S20 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S21 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S22 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S23 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S24 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S25 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S26 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S27 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |

Table 600-4. Low Level Scanner PCB Assembly (cont)

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | NOTE |
|------------|---------------------------------|-----------------------|---------------------|--------------|------------|------------|------|
| S28 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S29 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S30 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S31 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| S32 | SWITCH, DRY REED, SPST, 3W, 40V | 450627 | 89536 | 450627 | REF | | |
| U1② | IC, C-MOS, 1-OF-10 DECODER | 407981 | 12040 | MM74C42 | 1 | 1 | |
| XU1 | SOCKET, IC, 16-PIN | 276535 | 91506 | 316AG39D | 1 | | |

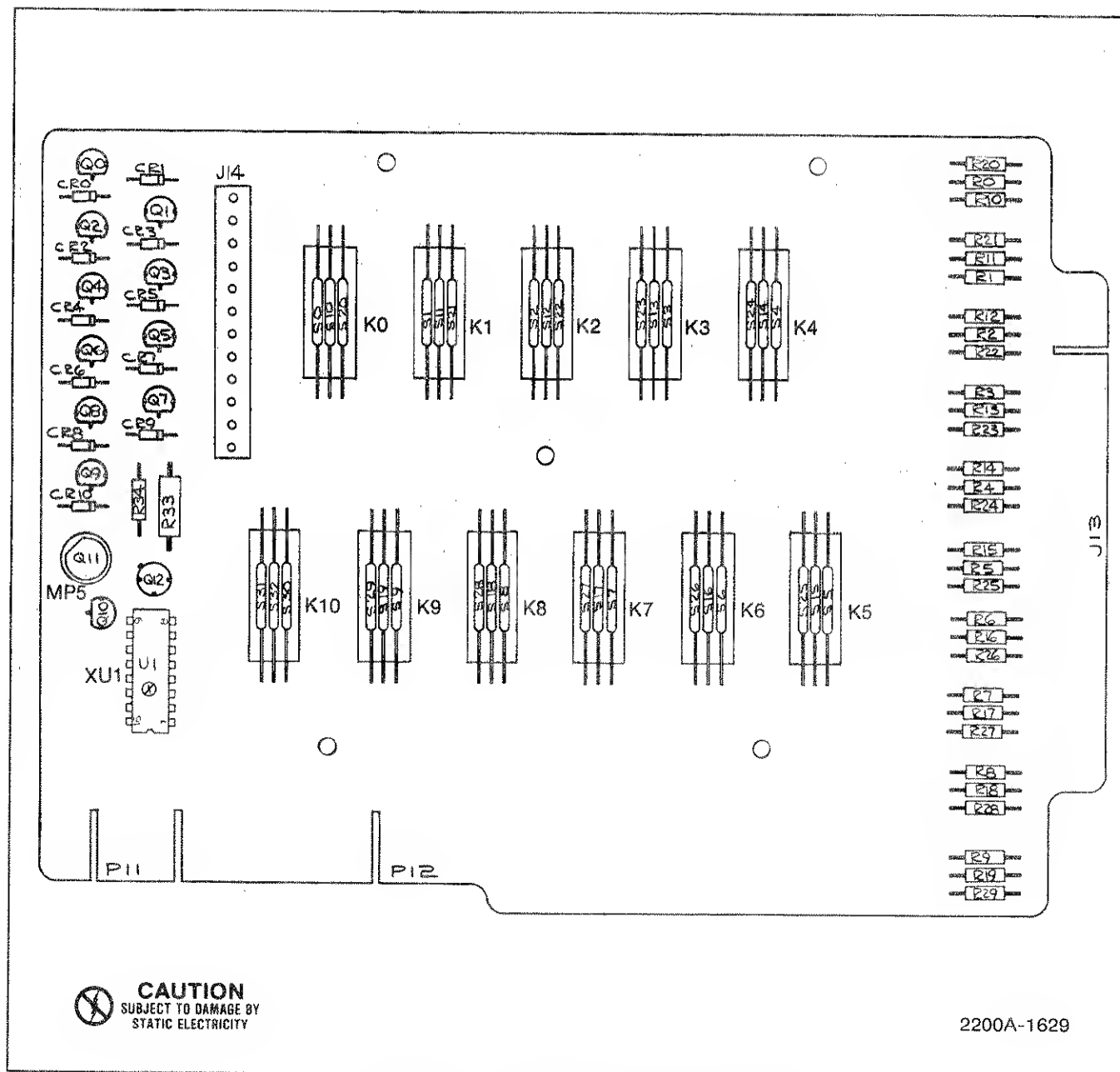
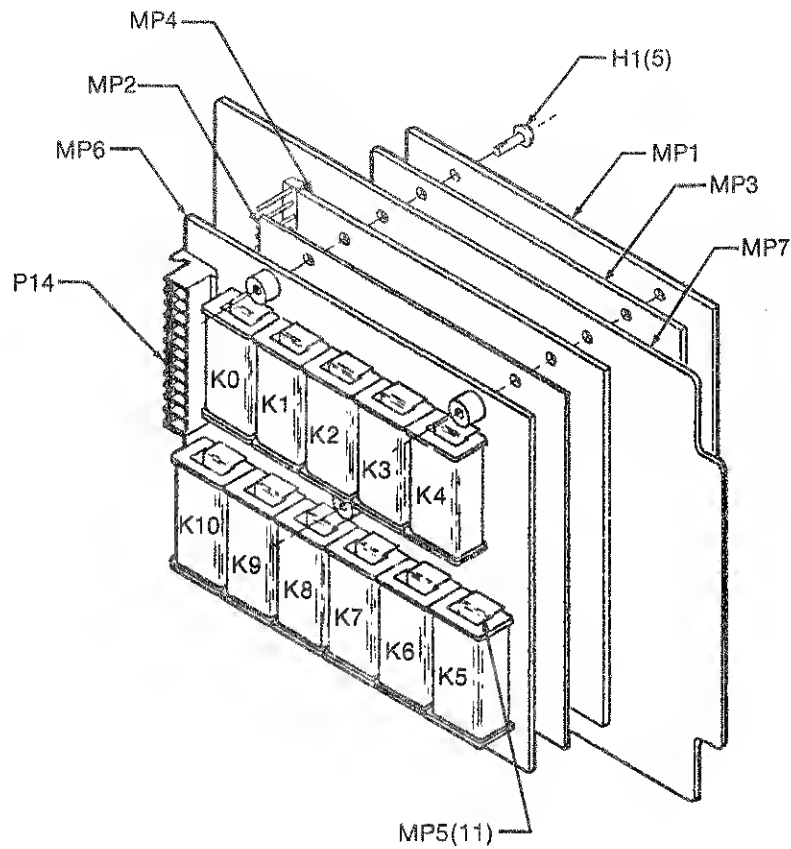


Figure 600-5. Low Level Scanner PCB Assembly

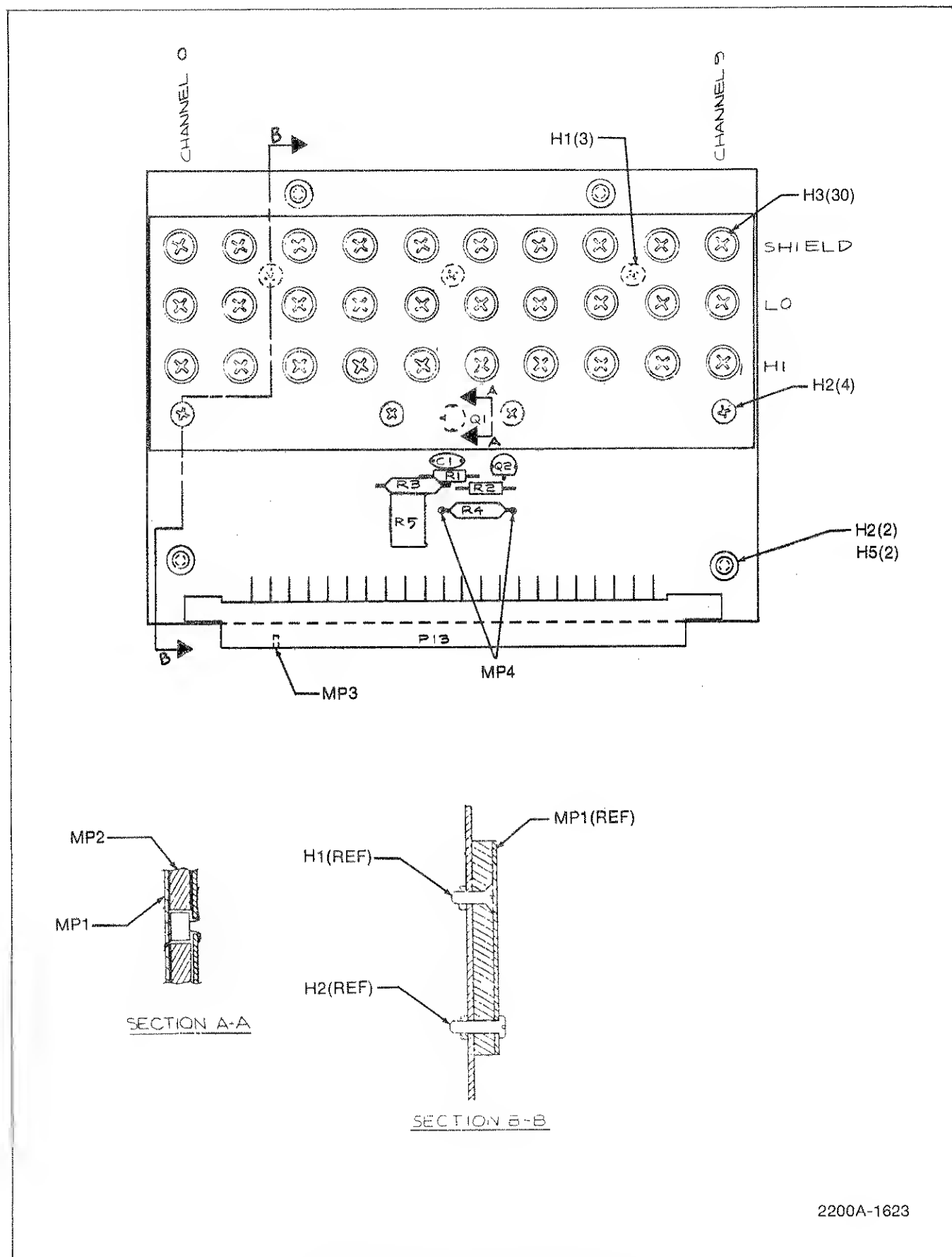


2200A-4029

Figure 600-5. Low Level Scanner PCB Assembly (cont)

Table 600-5. Isothermal Input Connector

| REF DES | DESCRIPTION | FLUKE STOCK NO. | MFG SPLY CODE | MFG PART NO. | TOT QTY | REC QTY | N O T E |
|------------|--|-----------------------|---------------------|----------------|------------|------------|------------------|
| -600A2 | ISOTHERMAL INPUT CONNECTOR FIGURE 600-6 (2200A-4023T) | 409573 | 89536 | 409573 | REF | | |
| C1 | CAP, CER 0.05 UF +/-20%, 50V | 149161 | 56289 | 55C23A1 | 1 | | |
| H1 | SCREW, FHP, S/S, 4-40 X 3/8 | 256024 | 89536 | 256024 | 3 | | |
| H2 | SCREW, PHP, 4-40 X 1/2 | 152132 | 89536 | 152132 | 4 | | |
| H3 | SCREW, PHP, 6-32 X 1/4 | 385401 | 89536 | 385401 | 30 | | |
| H4 | RIVET, #4 X .500 | 276493 | 89536 | 276493 | 2 | | |
| H5 | WASHER, FLAT #4 | 147728 | 89536 | 147728 | 2 | | |
| MP1 | INSULATOR, ISOTHERMAL BLOCK | 373340 | 89536 | 373340 | 1 | | |
| MP2 | ISOTHERMAL BLOCK | 412379 | 89536 | 412379 | 1 | | |
| MP3 | KEY, POLARIZING | 961060 | 00779 | 530374-1 | 1 | | |
| MP4 | SOCKET, COMPONENT LEAD | 343285 | 00779 | 2-331272-6 | 2 | | |
| P13 | CONNECTOR, BOARD-EDGE, 44-PIN | 385674 | 13511 | 225-22221-105 | 1 | | |
| Q1 | XSTR, SI, PNP (SELECTED) | 380394 | 89536 | 380394 | 1 | 1 | |
| Q2 | XSTR, FET, N-CHANNEL | 429977 | 89536 | 429977 | 1 | 1 | |
| R1 | RES, DEP. CAR, 330K, +/-5%, 1/4W | 376640 | 80031 | CR251-4-5P330K | 1 | | |
| R2 | RES, COMP, 4.7K +/-5%, 1/4W | 348821 | 01121 | CB4725 | 1 | | |
| R3 | RES, MTL. FILM, 130K +/-1%, 1/8W | 221648 | 91637 | MFF1-81303F | 1 | | |
| R4 | RES, FACTORY SELECTED | | | | | | |
| | (76.8K, 100K, 147K, 287K OR OPEN) | | | | | | |
| R5 | RES, VAR, CERMET, 150K +/-10% | 414102 | 11236 | 360T151A | 1 | 1 | |



2200A-1623

Figure 600-6. Isothermal Input Connector

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Section 8

Manual Change Information

INTRODUCTION

This section contains information necessary to backdate the manual to conform with earlier pcb configurations. To identify the configuration of the pcb's used in your instrument, refer to the revision letter (marked in ink) on the component side of each pcb assembly. Table 8-1 defines the assembly revision levels documented in this manual.

NEWER INSTRUMENTS

As changes and improvements are made to the instrument, they are identified by incrementing the revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual.

OLDER INSTRUMENTS

To backdate this manual to conform with earlier revision levels, perform the changes indicated in Table 7A-1.

CHANGES

The following design changes, unless otherwise noted, affect only Section 6 and Section 9 of this manual:

- Section 6, parts list and component location drawings.
- Section 9, schematics and component location drawings.

The material affected within these sections is easily determined by the type of change. See Table 8-2.

Table 8-1. Manual Status and Backdating Information

| Ref Or Option No. | Assembly Name | Fluke Part No. | * To adapt manual to earlier rev configurations perform changes in descending order (by no.), ending with change under desired rev letter | | | | | | | | | | | | | | | | | |
|---|---------------------------------|----------------------|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|--|
| | | | — | A | B | C | D | E | F | G | H | J | K | L | M | N | P | | | |
| A1 | FRONT PANEL DISPLAY PCB ASSY | 611061 | — | | | | | | | | | | | | | | | | | |
| A2 | MOTHER BOARD PCB ASSY | 468132 | | | | X | | | | | | | | | | | | | | |
| A3 | POWER SUPPLY PCB ASSY | 611897 | | | X | | | | | | | | | | | | | | | |
| A4 | EXTENDER BUS PCB ASSY | 611087 | — | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| * X = The PCB revision levels documented in this manual. ● = These revision letters were never used in the instrument. — = No revision letter on the PCB. | | | | | | | | | | | | | | | | | | | | |

Table 8-2. Material Affected By a Change

| TYPE OF CHANGE | MATERIAL AFFECTED = • | | |
|--------------------------------|-----------------------|-----------|--------------------|
| | Parts List | Schematic | Component Location |
| Electrical Value | • | • | |
| Part Number | • | | |
| Hardware | • | | • |
| Size/Location (physical) | | | • |
| Addition/Deletion (electrical) | • | • | • |

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Damascus, Syria

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6th Fl Cathay Min-Sheng
Commercial Bldg, 344
Min-Sheng East Road
Taipel 104, Taiwan
Tel: 501-3468, TLX: (785) 11111

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TLX: 21027 EMVEN VE

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Fluke (Deutschland) GmbH
Tel: (089) 96050
TLX: 0522472



John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, WA 98206
Fluke (Holland) B.V., P.O. Box 5053, 5004 EB, Tilburg, The Netherlands. Phone (013) 673973
Litho in U.S.A. 4/84

Section 9

Schematic Diagrams

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| | |
|--------------|--------------------------|
| UL | Unguarded Logic |
| GL | Guarded Logic |
| D80-D87 | Data Bus (7-Bit) |
| REN | Remote Enable |
| WR | Write |
| TO | Clock Output |
| ALE | Address Latch Enable |
| RD | Read |
| PORT 0 EN | Port 0 (Zero) Enable |
| IFC | Interface Clear |
| WR DIS | Write Disabled |
| SD | Serial Data |
| SC | Serial Clock (BCD) |
| CS0 thru CS3 | Channel Select (BCD) |
| DS0 thru DS3 | Decade Select (BCD) |
| HS0 thru HS3 | Hundreds Select |
| REF COM | Reference Common |
| HIGH | Analog High |
| LO | Analog Low |
| A/D COM | Analog-to-Digital Common |
| BS0 thru BS9 | Block Select 0 thru 9 |
| A COM | Analog Common |
| DIO | Data Input/Output |
| DAV | Data Valid |
| ATN | Attention |
| RFD | Ready For Data |
| DAC | Data Accepted |
| EOI | End Or Identify |
| SRQ | Service Request |

Figure 9-1. Mnemonics

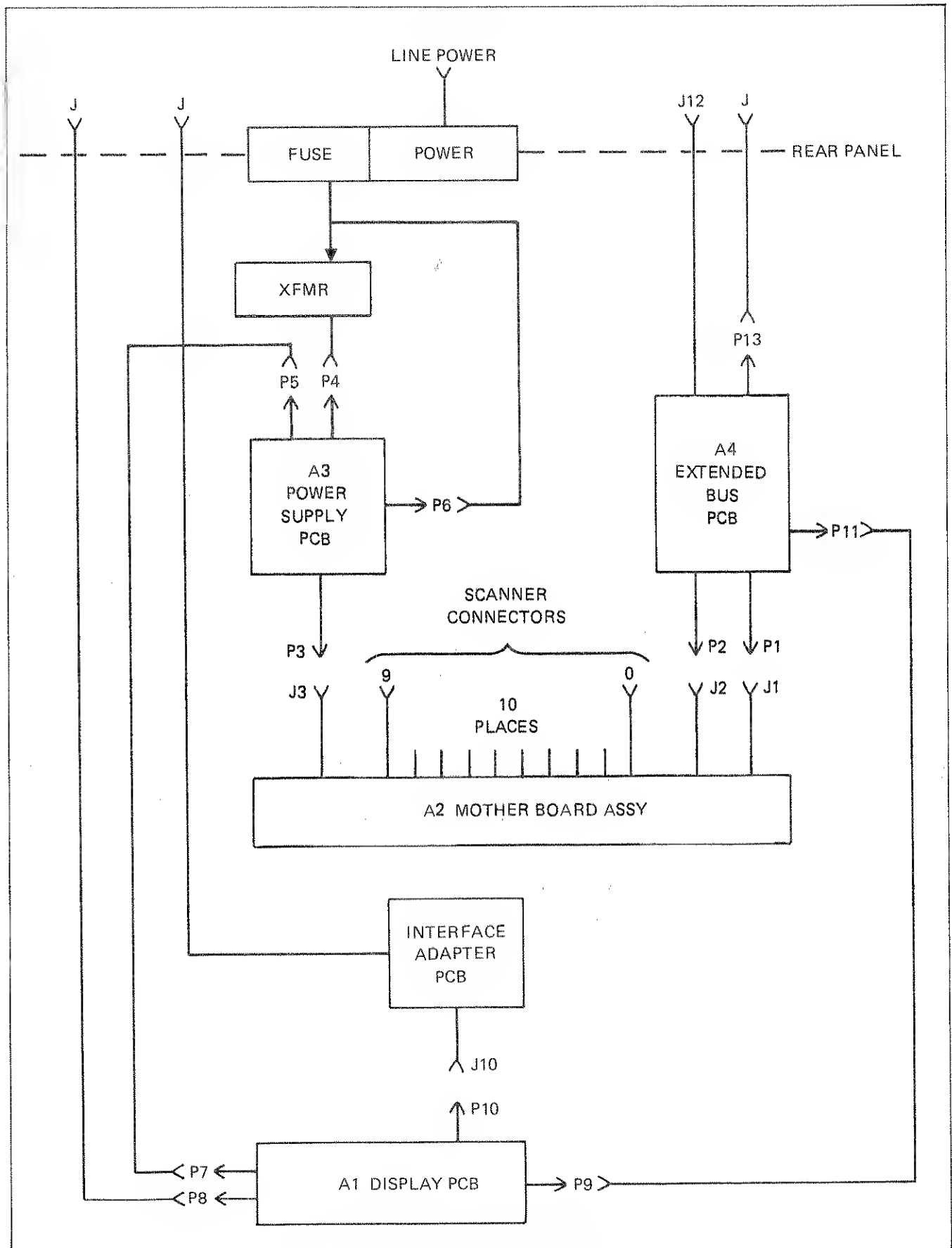
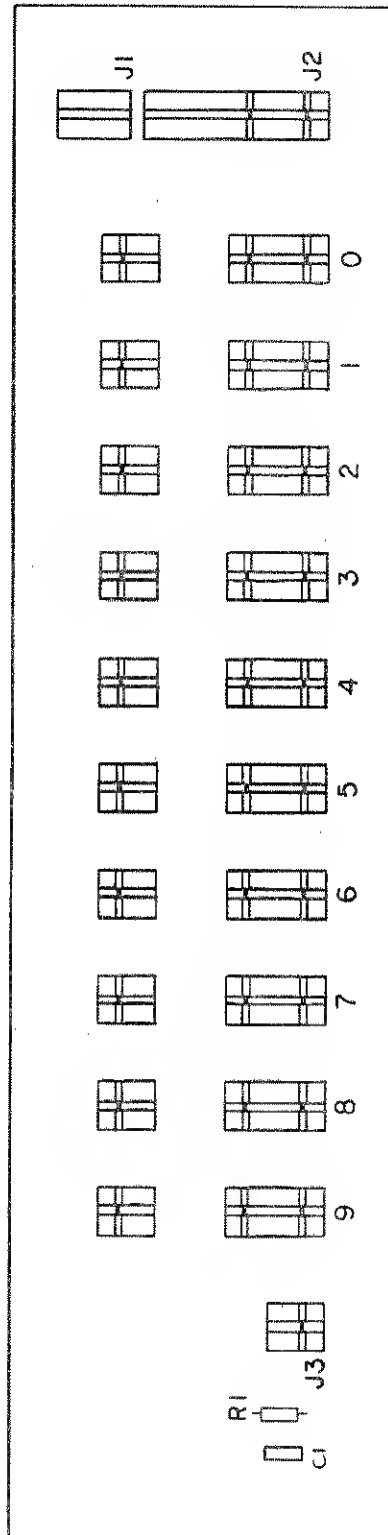
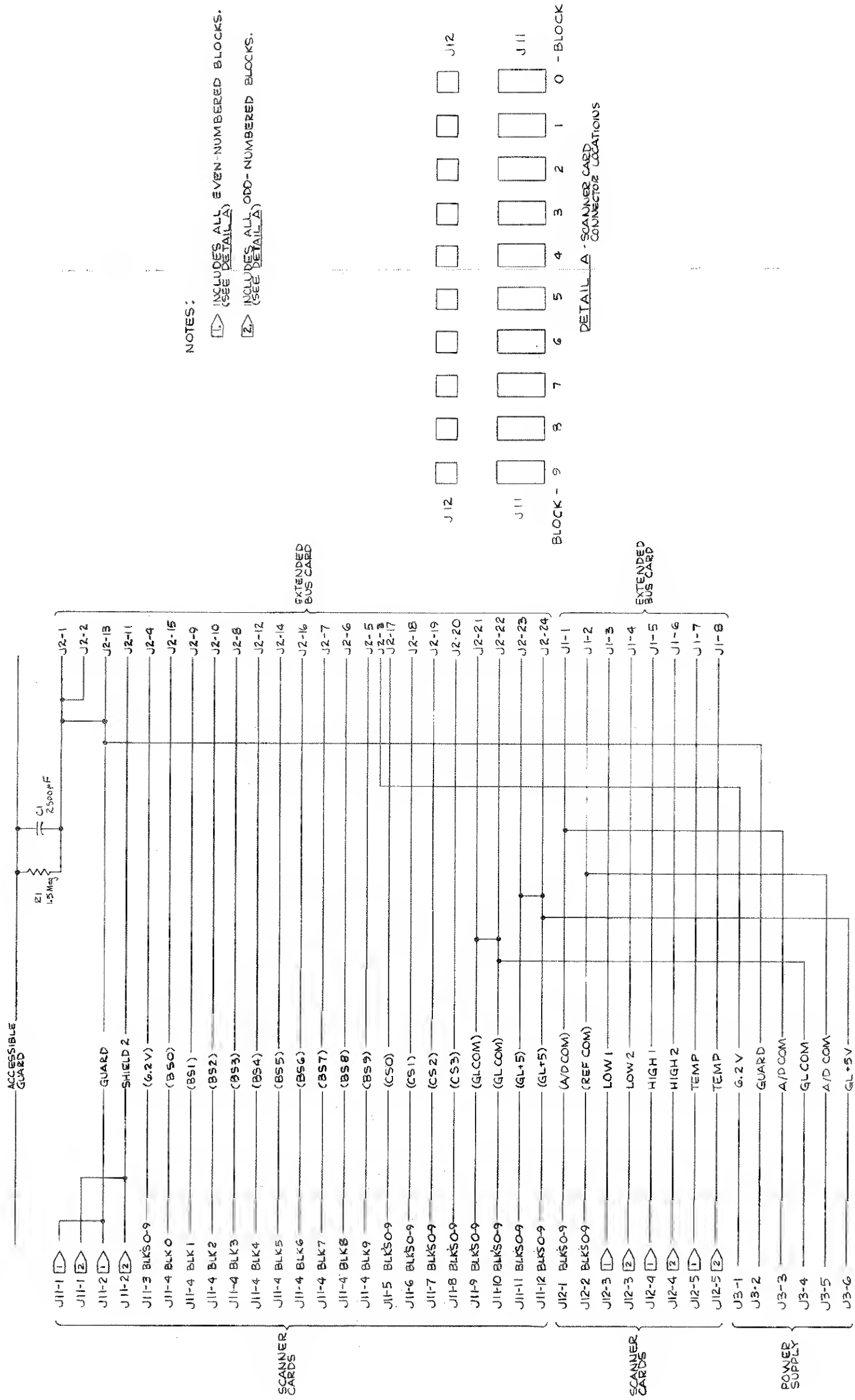


Figure 9-2. 2205A Interconnect Diagram



2204A-1701

Figure 9-3. A2 Mother Board PCB Assembly

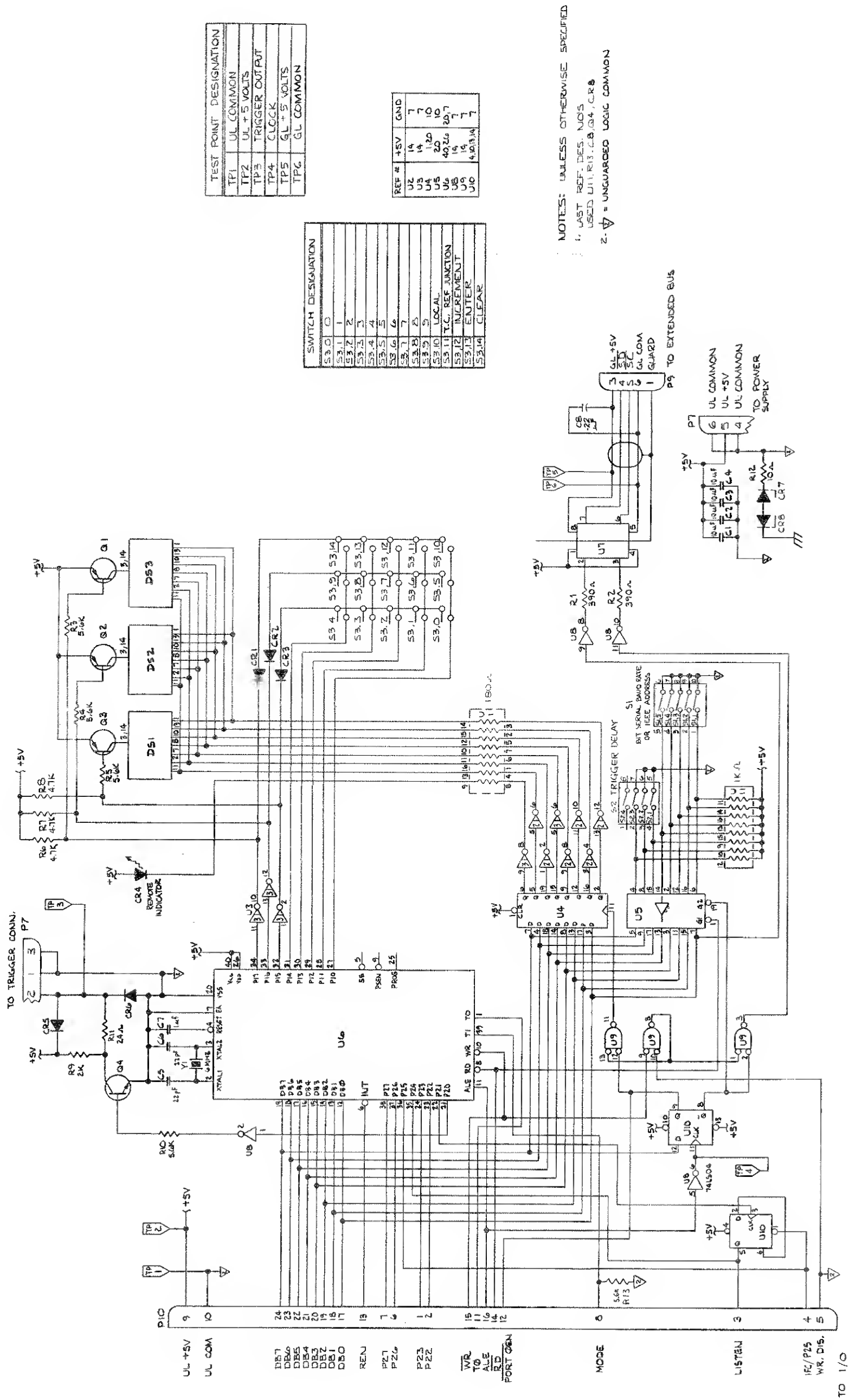


2204A-1001

Figure 9-3. A2 Mother Board PCB Assembly (cont)

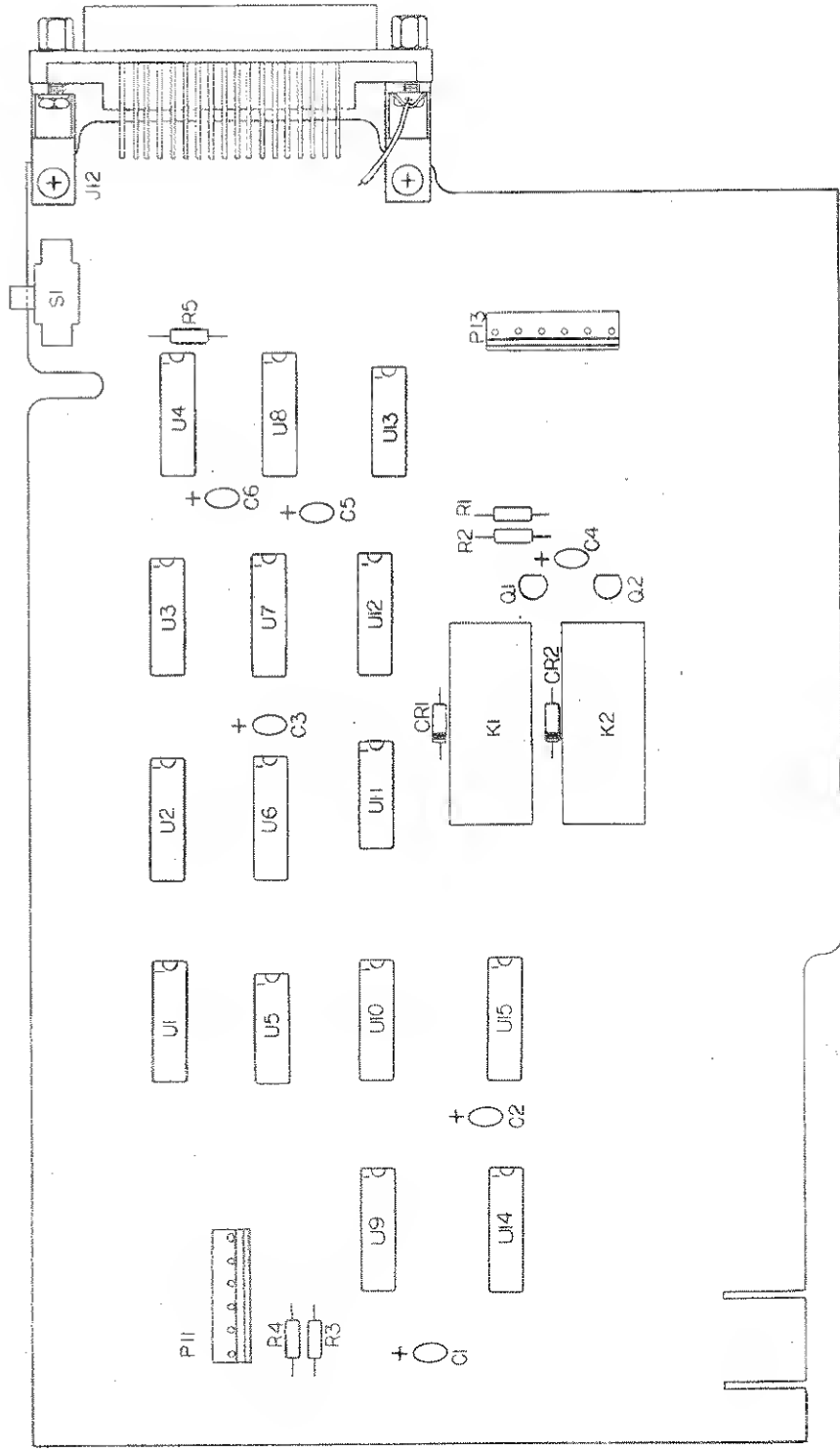


9-6



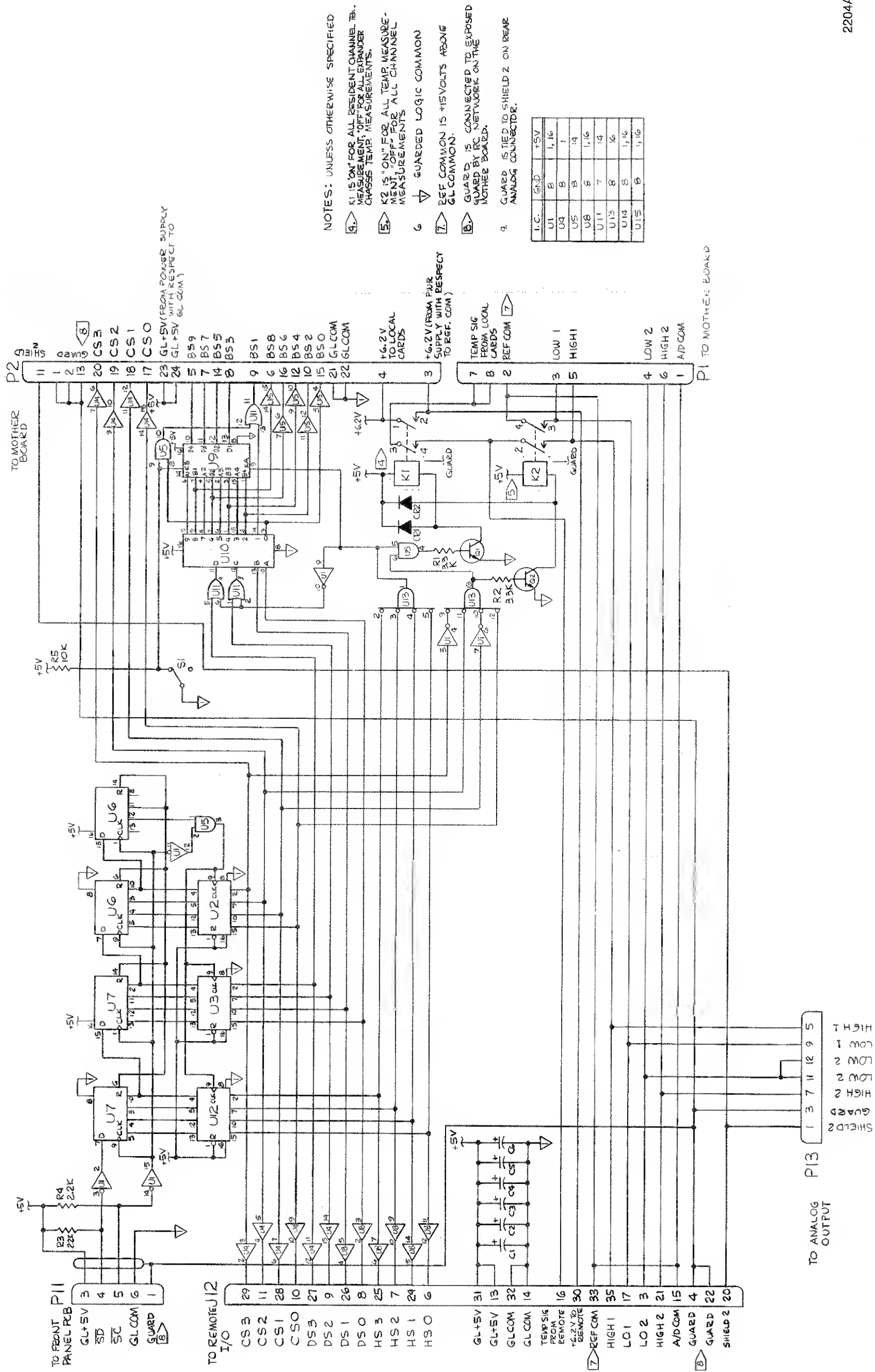
2204A-1010

Figure 9-4. A1 Front Panel Display PCB Assembly (cont)



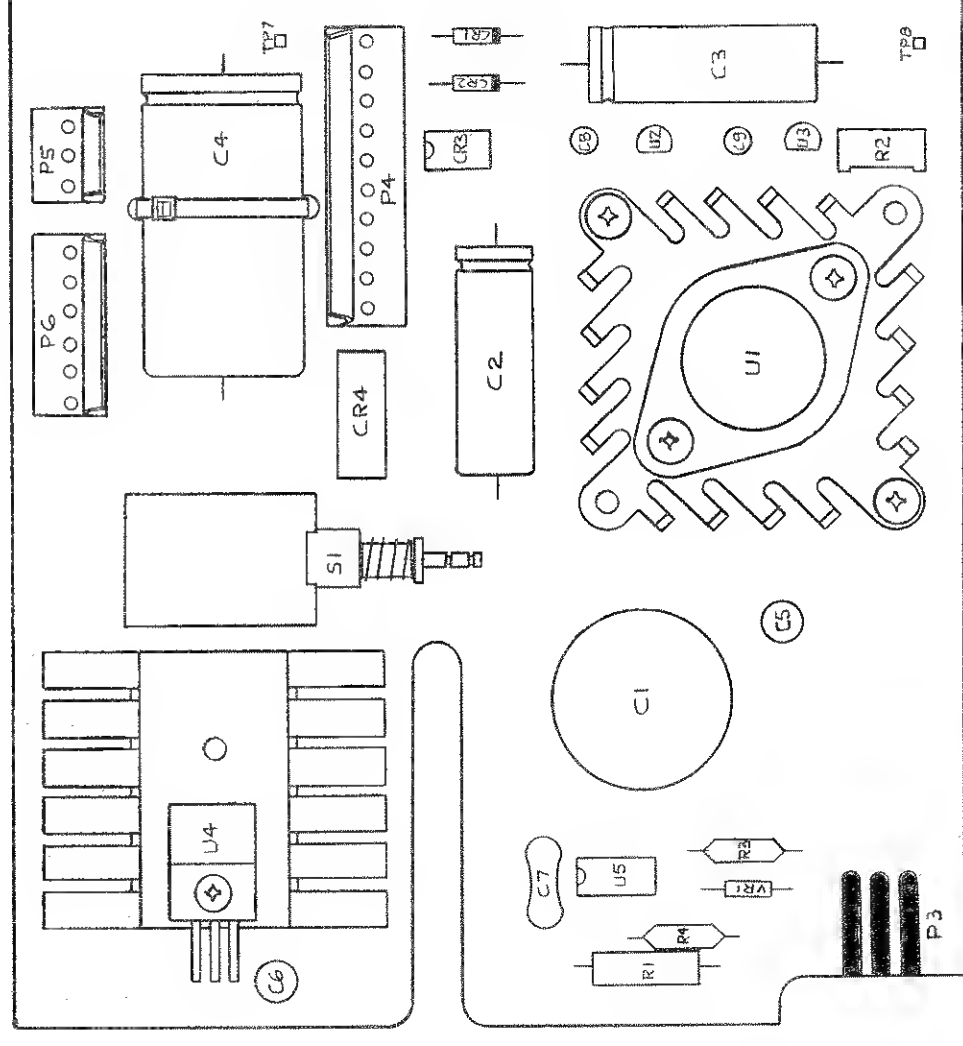
2204A-1715

Figure 9-5. A4 Extender Bus PCB Assembly



2204A-1015

Figure 9-5. A4 Extender Bus PCB Assembly (cont)



2205A-1605

Figure 9-6. A3 Power Supply PCB Assembly

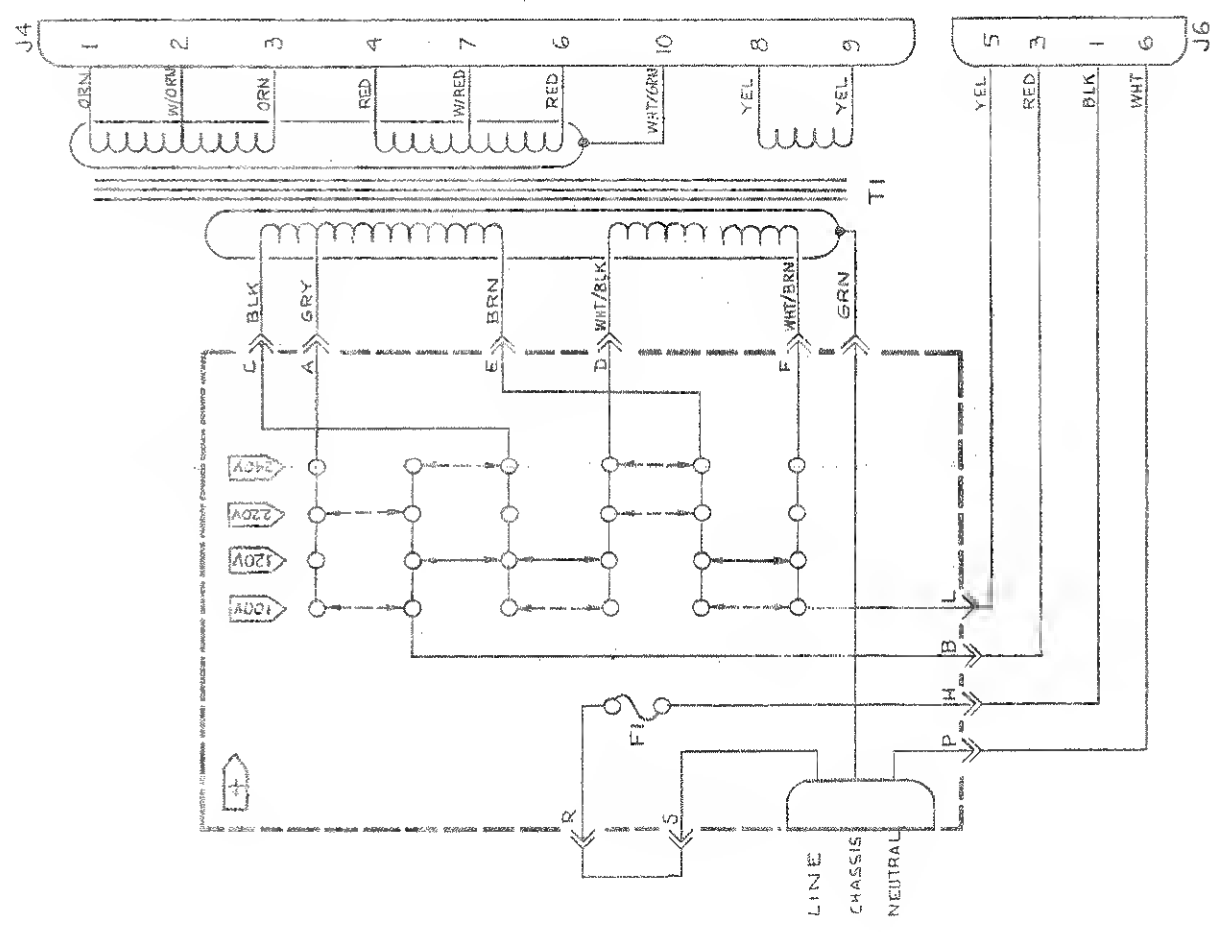
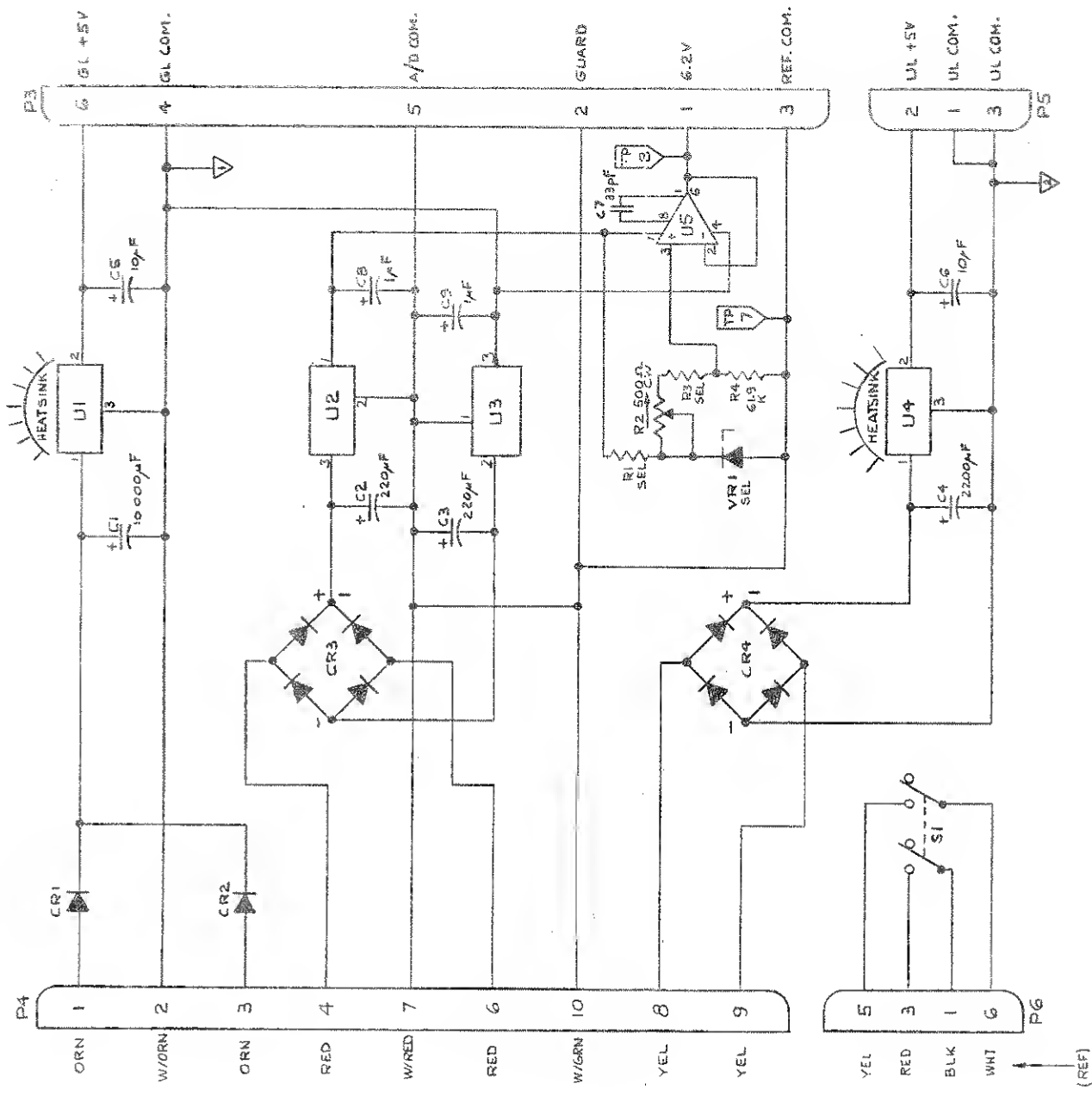
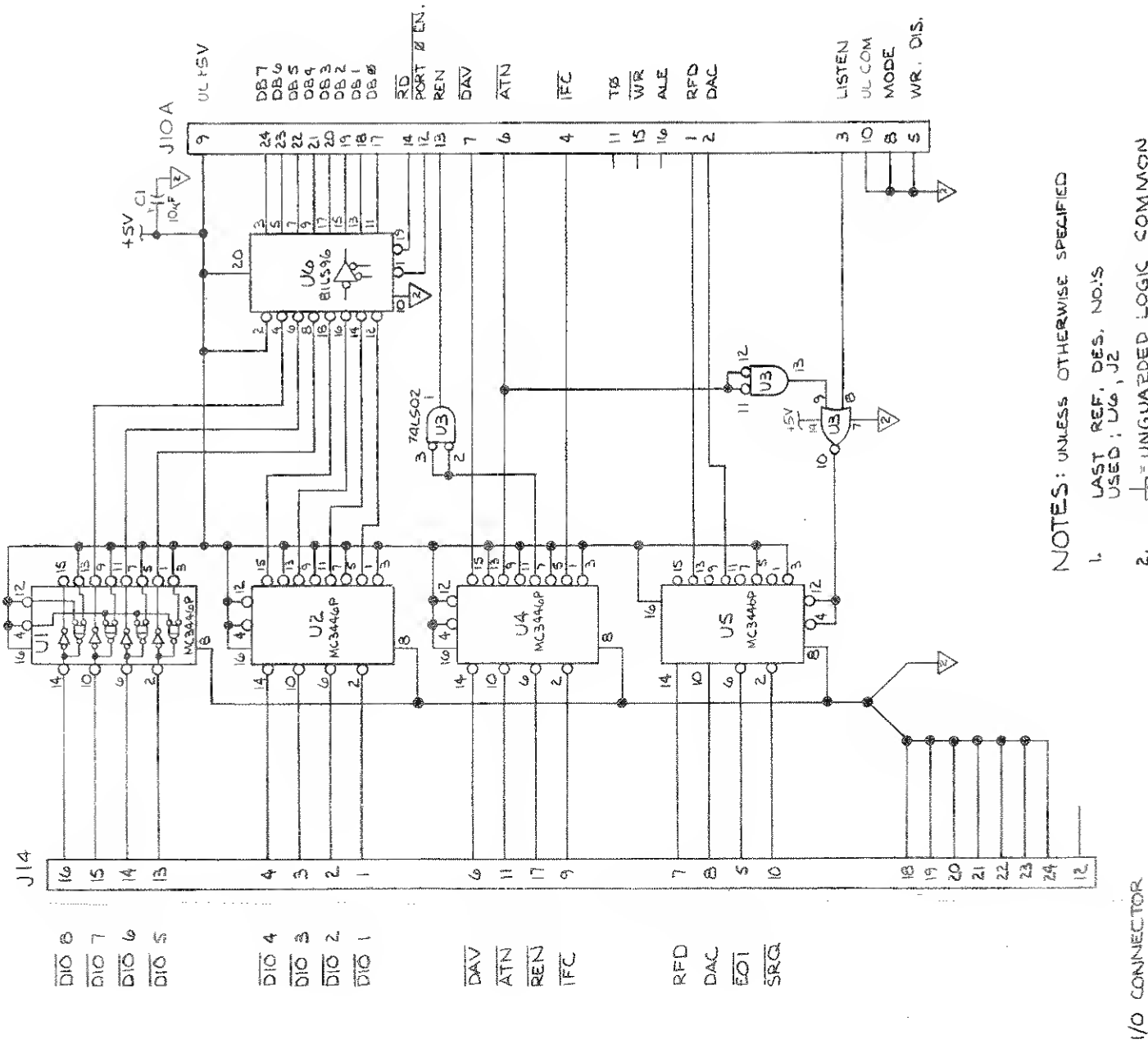


Figure 9-6. A3 Power Supply PCB Assembly (cont)



NOTES: UNLESS OTHERWISE SPECIFIED

1. LAST REF. DES. NO.'S USED: U6, J2
2. UNQUARDED LOGIC COMMON
3. CORRESPONDING IEEE-488 PCB IS CONFIGURED AS -C80 OPTION FOR THE 2204A.

2204A-1712

2204A-1012

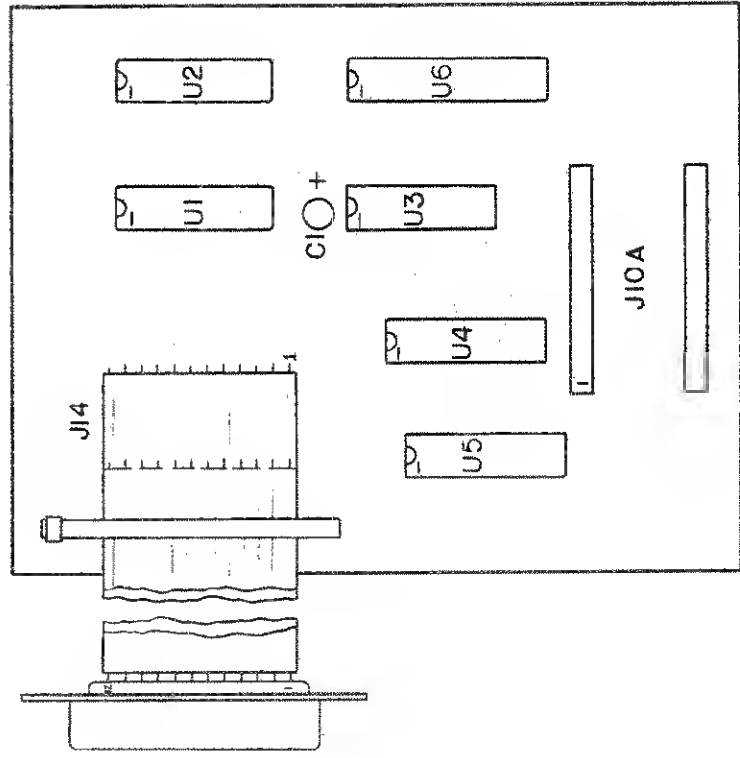
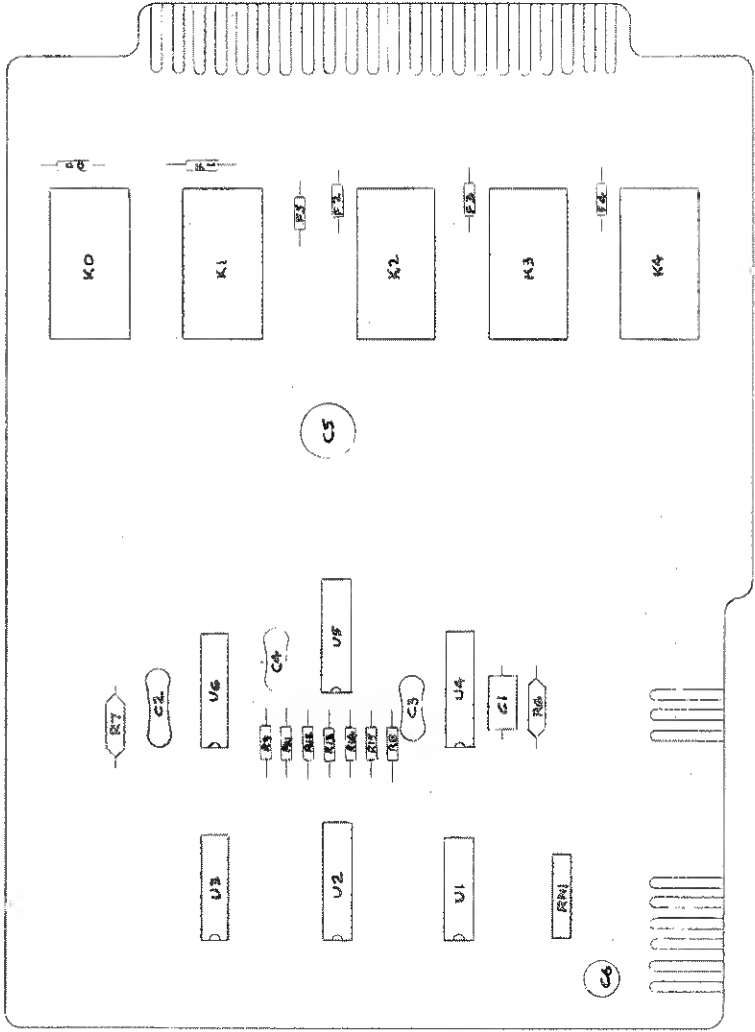
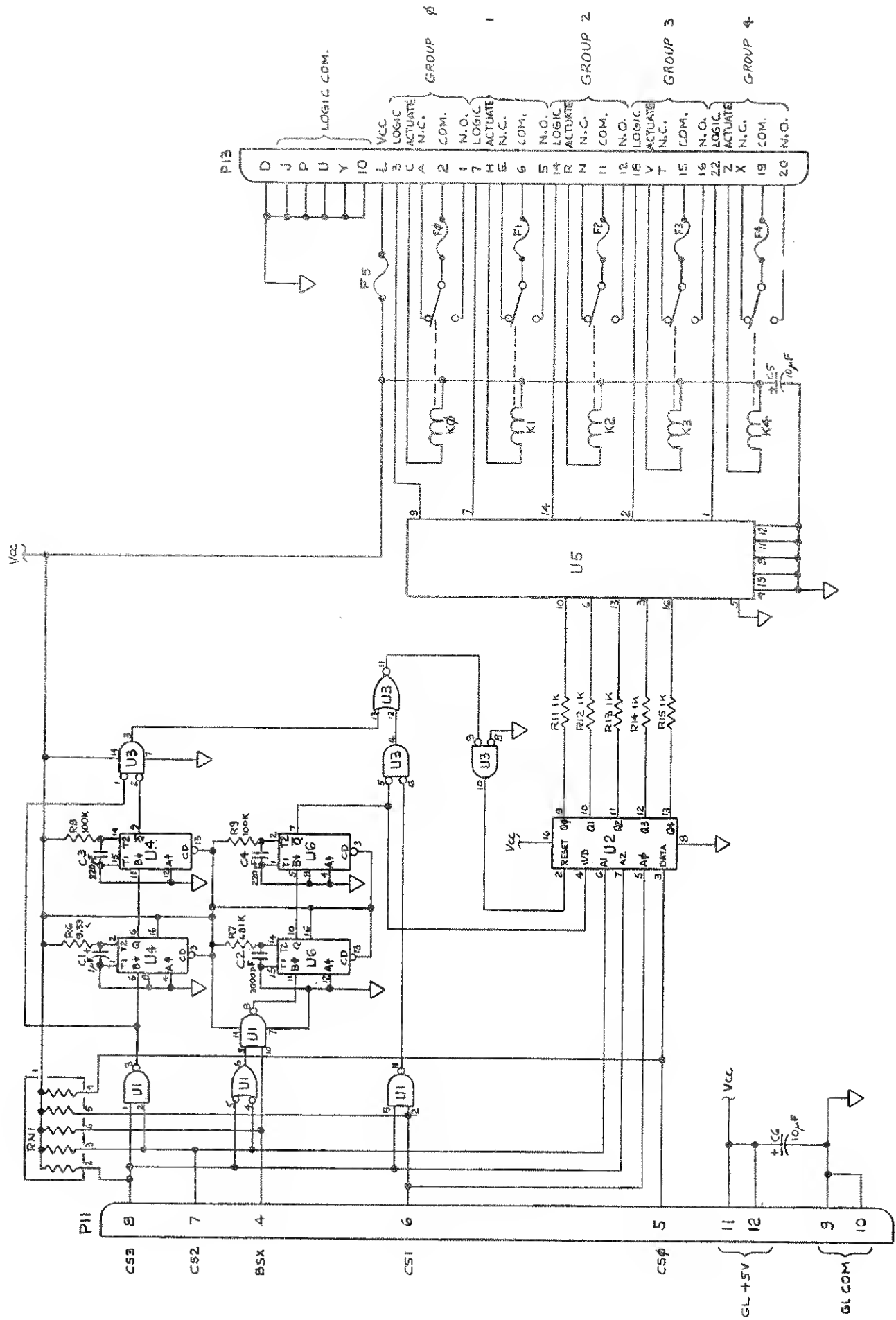


Figure 9-7. Option -050, IEEE-488 Compatible Interface PCB Assembly



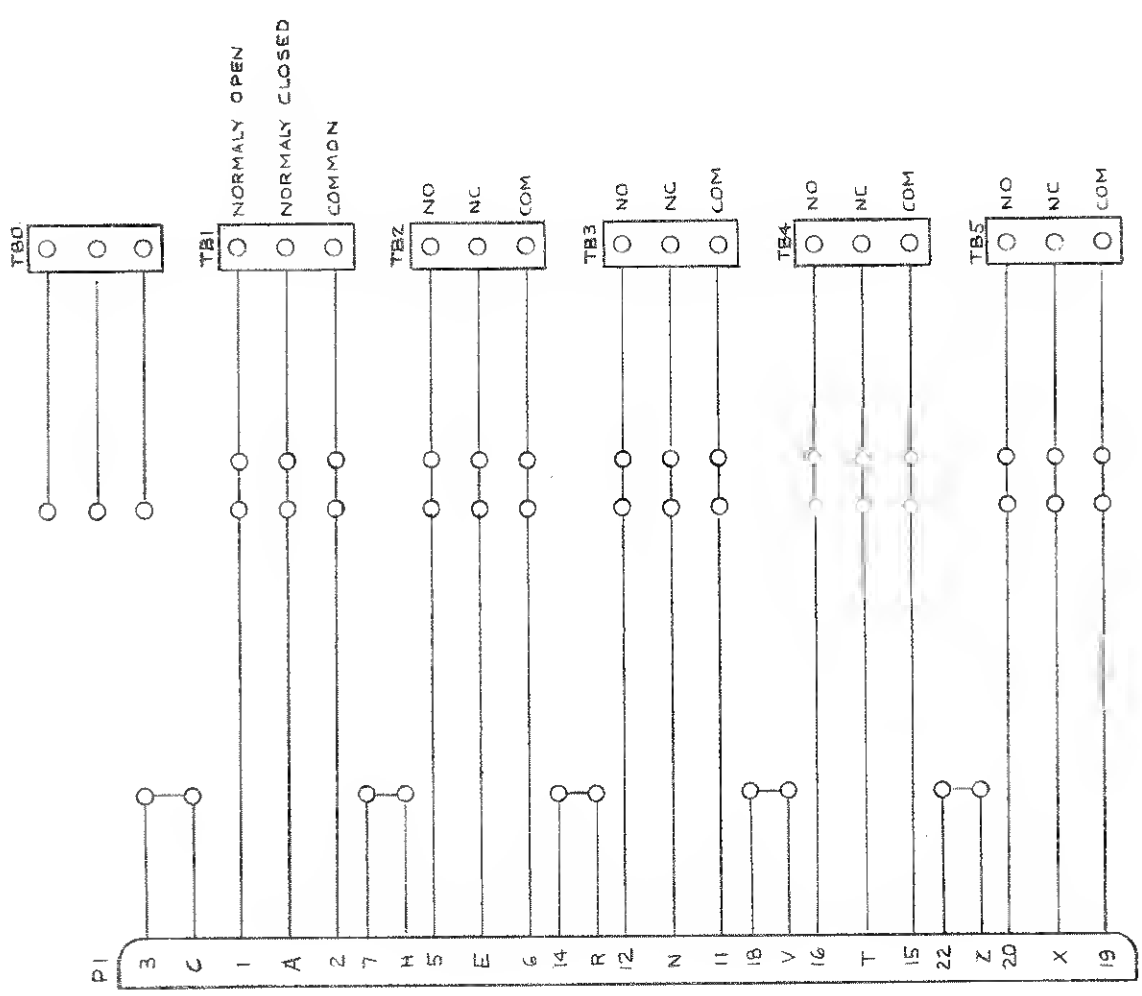
2205A-1602
Actuator PCB Assembly

Figure 9-9. Option -100, Actuator Module



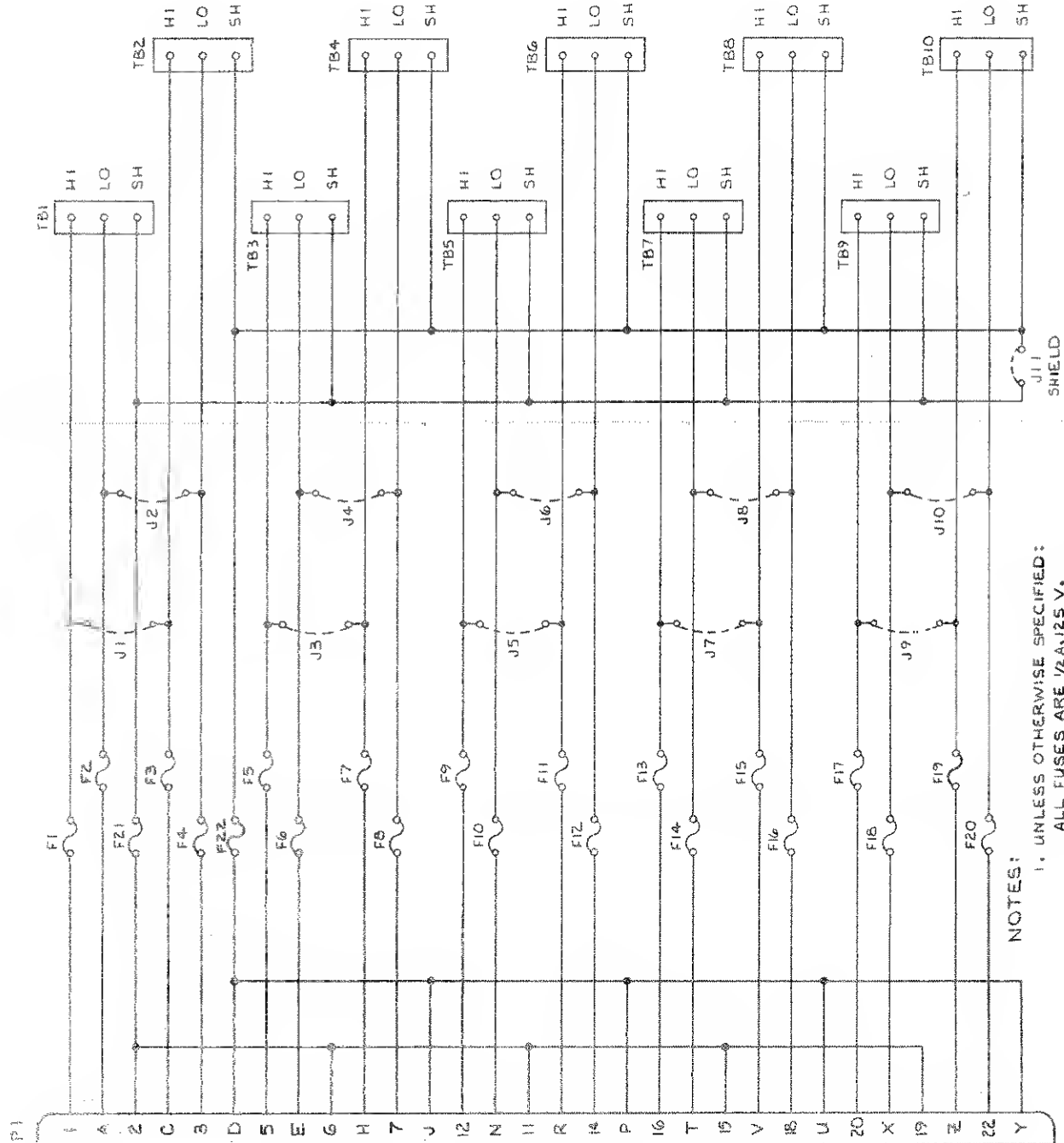
2205A-1002
Actuator PCB Assembly

Figure 9-9. Option -100, Actuator Module (cont)



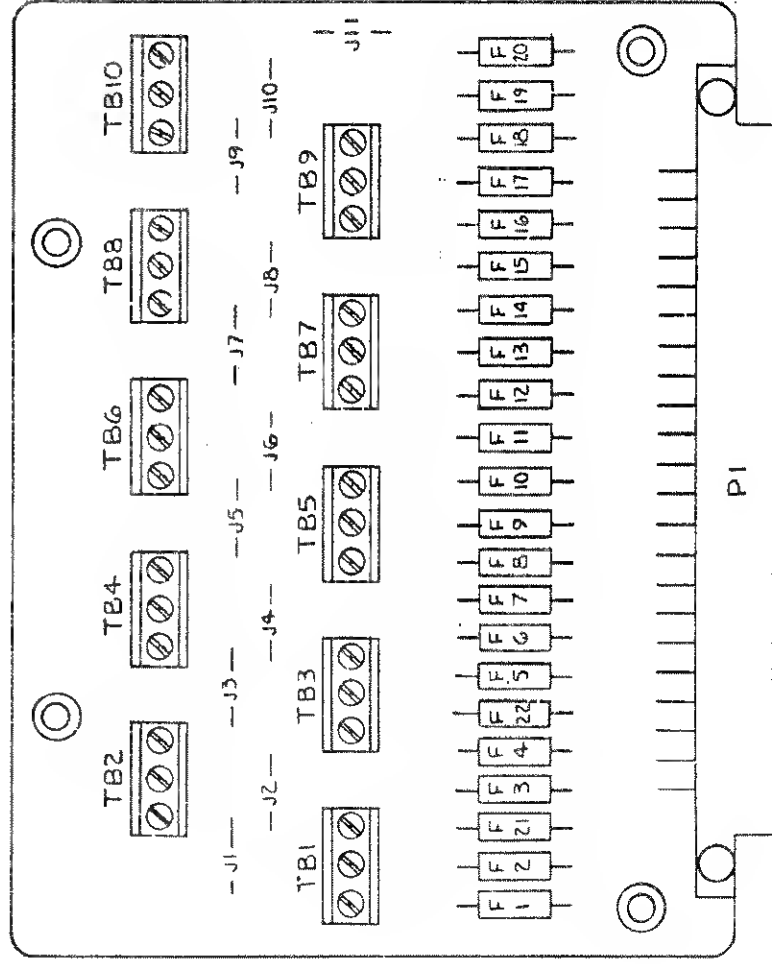
2205A-1006
Screw Terminal Connector

Figure 9-9. Option -100, Actuator Module (cont)



- NOTES:
- 1. UNLESS OTHERWISE SPECIFIED:
ALL FUSES ARE 1/2A, 125 V.
 - 2. DESIGNATIONS OF TERMINAL STRIPS WHEN
USED WITH GENERAL PURPOSE SCANNING
& LATCHING CARDS SHOWN IN TABLE BELOW:

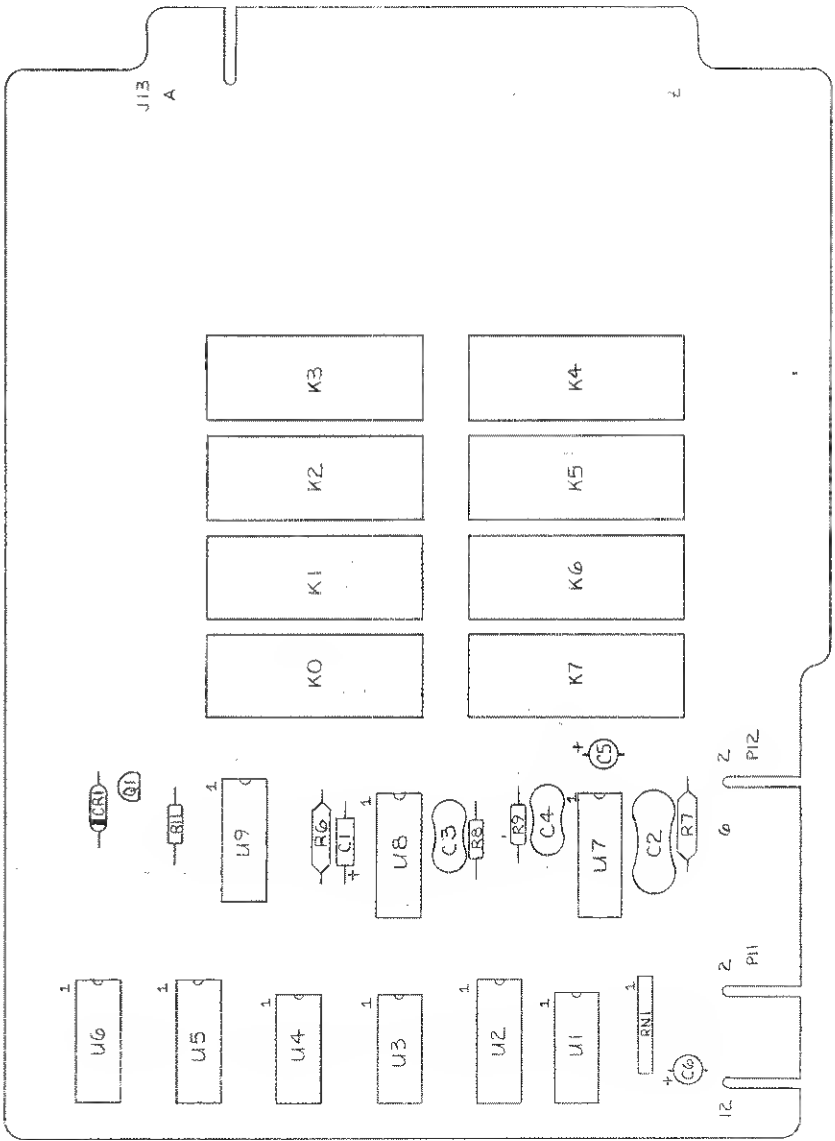
| TERMINAL STRIP | LATCHING | SCANNING |
|----------------|----------|----------|
| TB1 | CH0 | CH0 |
| TB2 | CH4 | CH1 |
| TB3 | CH1 | CH2 |
| TB4 | CH5 | CH3 |
| TB5 | CH2 | CH4 |
| TB6 | CH6 | CH5 |
| TB7 | CH3 | CH6 |
| TB8 | CH7 | CH7 |
| TB9 | BUS A | CH8 |
| TB10 | BUS B | CH9 |



2205A-4007
Fused Terminal PCB Assembly

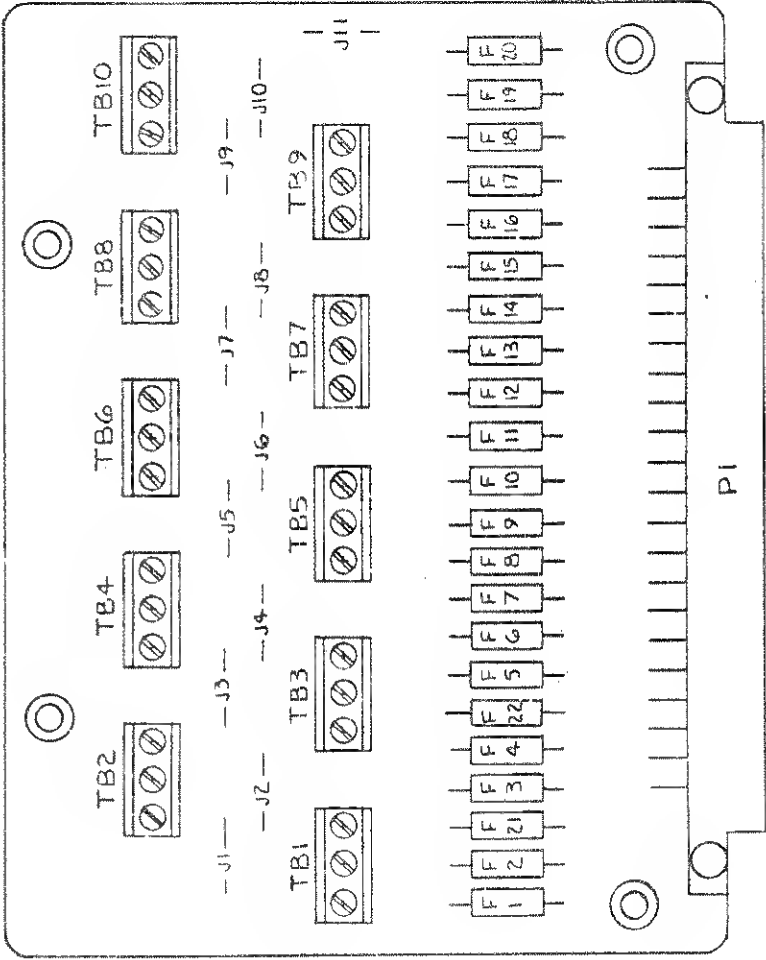
2205A-1007
Fused Terminal Connector

Figure 9-10. Option -200, Latching Module



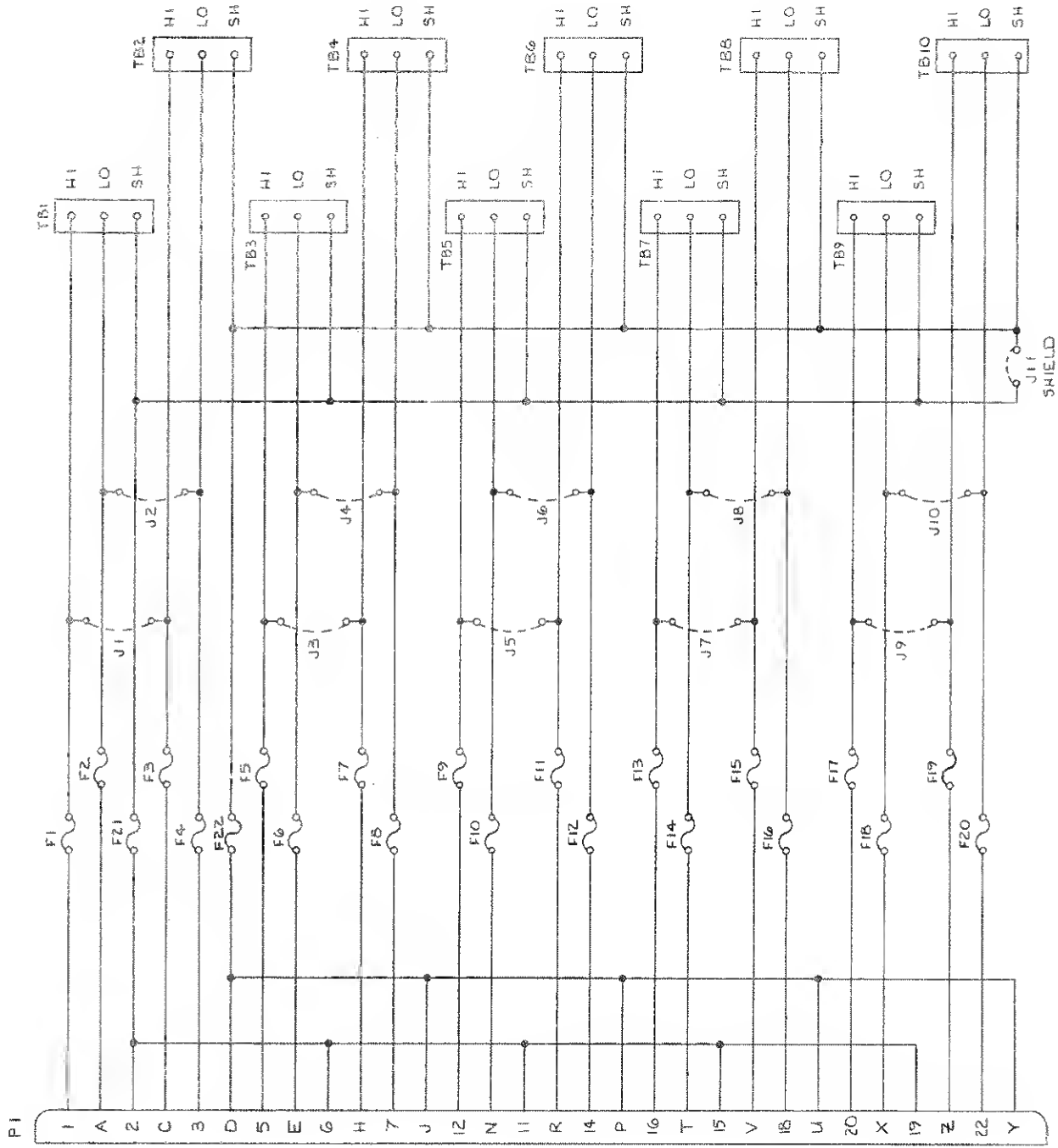
2205A-1603
Latching PCB Assembly

Figure 9-10. Option -200, Latching Module (cont)



2205A-1607
Fused Terminal Connector

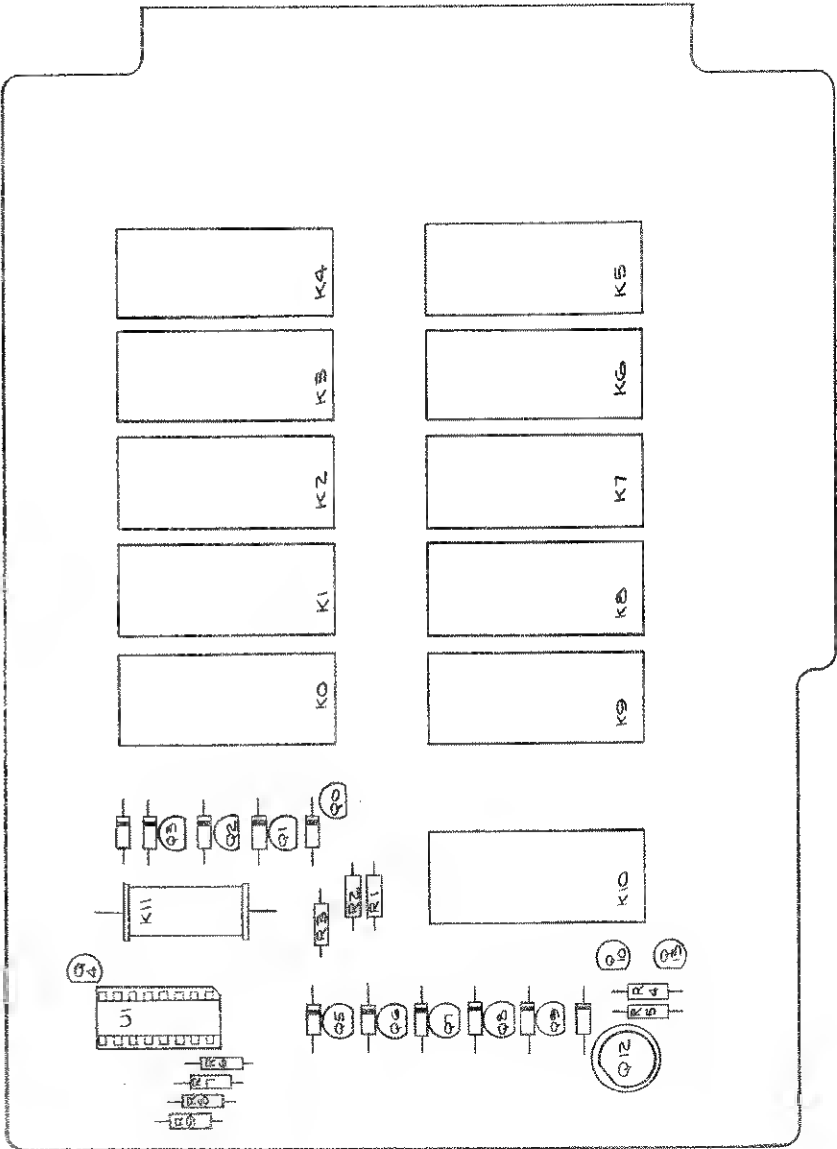
Figure 9-11. Option -300, General Purpose Scanner
Module



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
ALL FUSES ARE 1/2 A, 25 V.
2. DESIGNATIONS OF TERMINAL STRIPS WHEN
USED WITH GENERAL PURPOSE SCANNING
& LATCHING CARDS SHOWN IN TABLE BELOW:

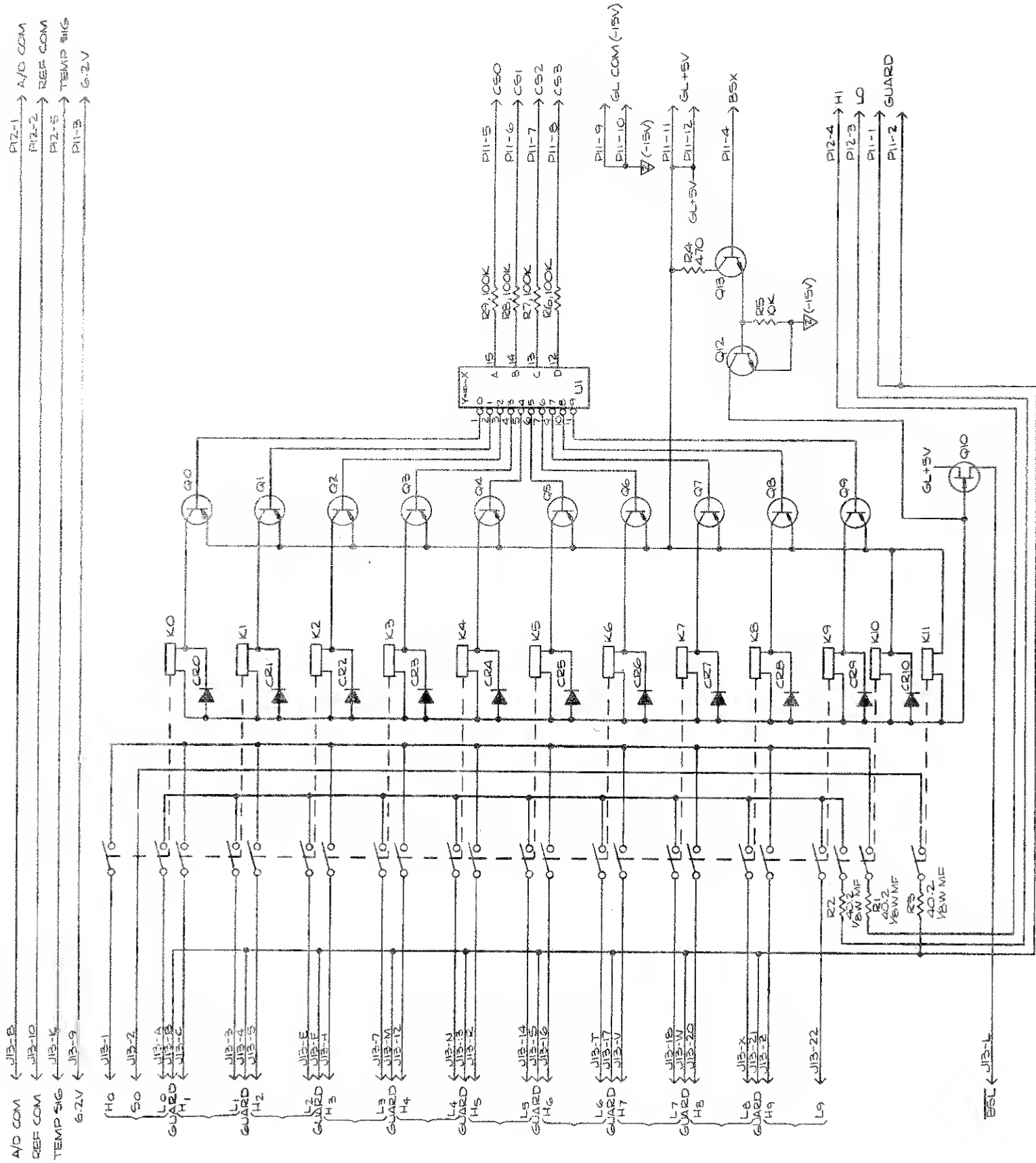
| TERMINAL STRIP | LATCHING | SCANNING |
|----------------|----------|----------|
| TB1 | CH0 | CH0 |
| TB2 | CH4 | CH1 |
| TB3 | CH1 | CH2 |
| TB4 | CH5 | CH3 |
| TB5 | CH2 | CH4 |
| TB6 | CH6 | CH5 |
| TB7 | CH3 | CH6 |
| TB8 | CH7 | CH7 |
| TB9 | BUS A | CH8 |
| TB10 | BUS B | CH9 |

Figure 9-11. Option -300, General Purpose Scanner
Module (cont)



2200A-1637
General Purpose Scanner PCB Assembly

Figure 9-11. Option -300, General Purpose Scanner
Module (cont)

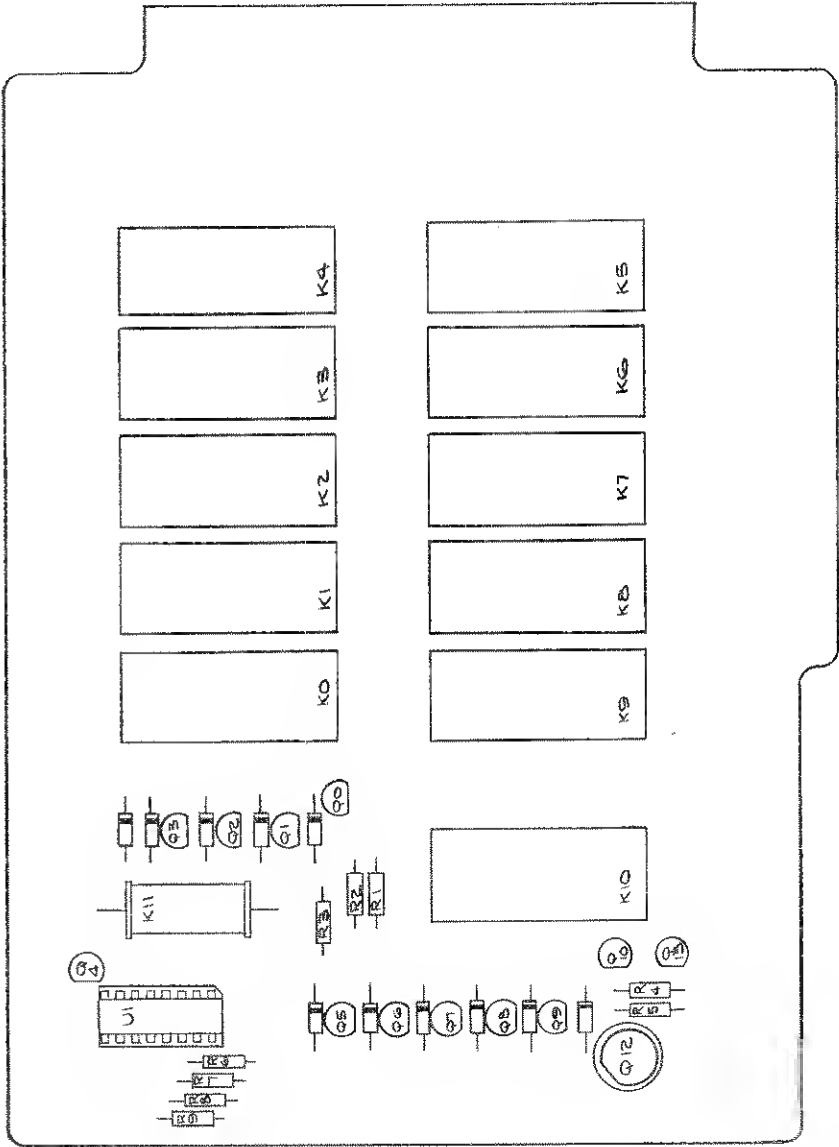


- NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
 2. ∇ (-15V) DENOTES GUARDED LOGIC COMMON [GL COM (-15V)] WHICH IS -15V WITH RESPECT TO A/D COM.
 3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
 4. ALL VOLTAGES NOTED ARE WITH RESPECT TO A/D COM.

| REF DES | U1 | PIN NO. | GL COM | GL COM |
|---------|----|---------|--------|--------|
| | | 16 | | |

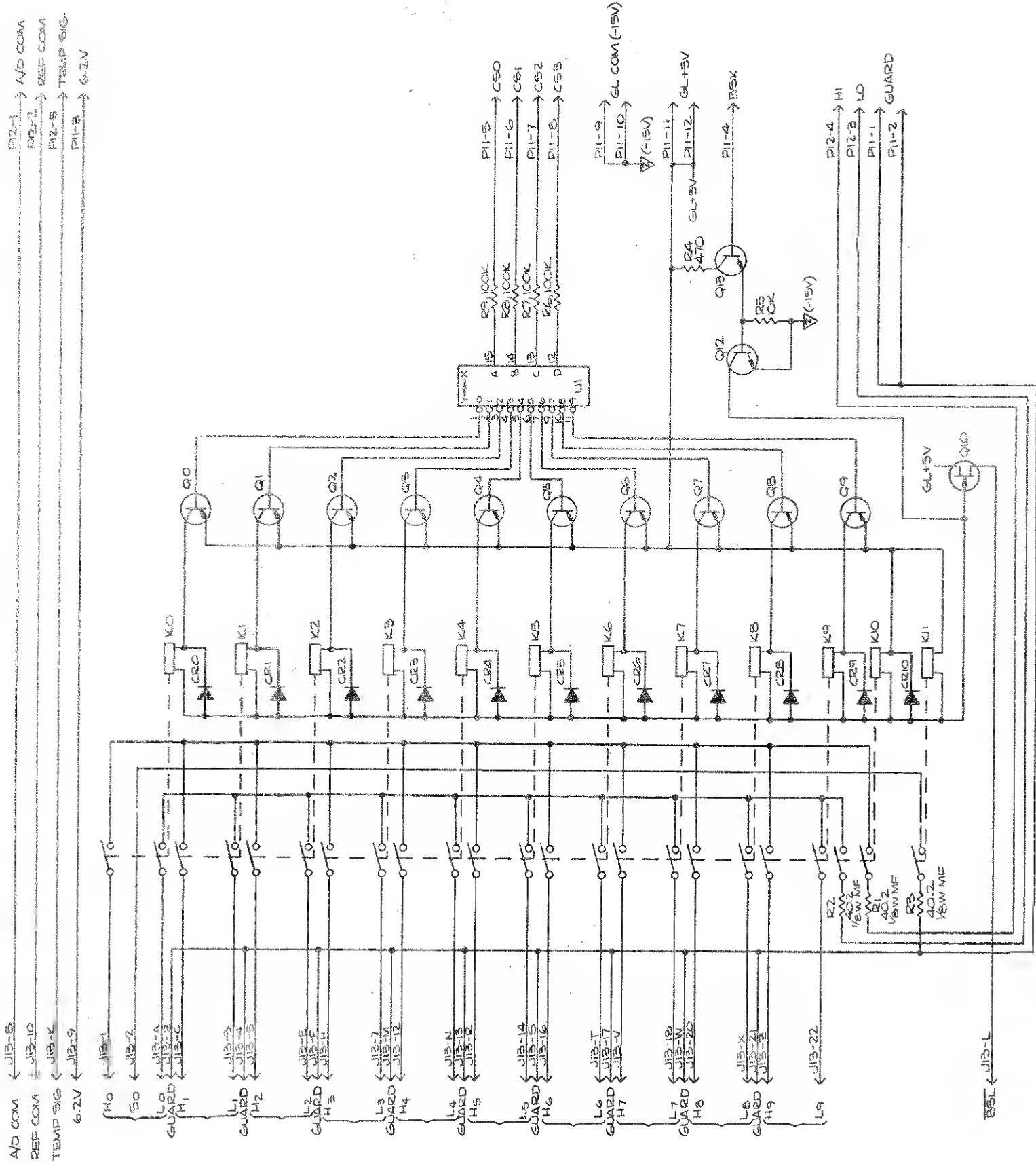
| REFERENCE DESIGNATIONS | LAST USED | NOT USED |
|------------------------|-----------|----------|
| CR10 | U1 | Q11 |
| K11 | | |
| CR9 | | |

2200A-1037
General Purpose PCB Assembly
Figure 9-11. Option -300, General Purpose Scanner Module (cont)



2200A-1637
General Purpose Scanner PCB Assembly

Figure 9-12. Option -400, Four-Wire Resistance
Scanner Module



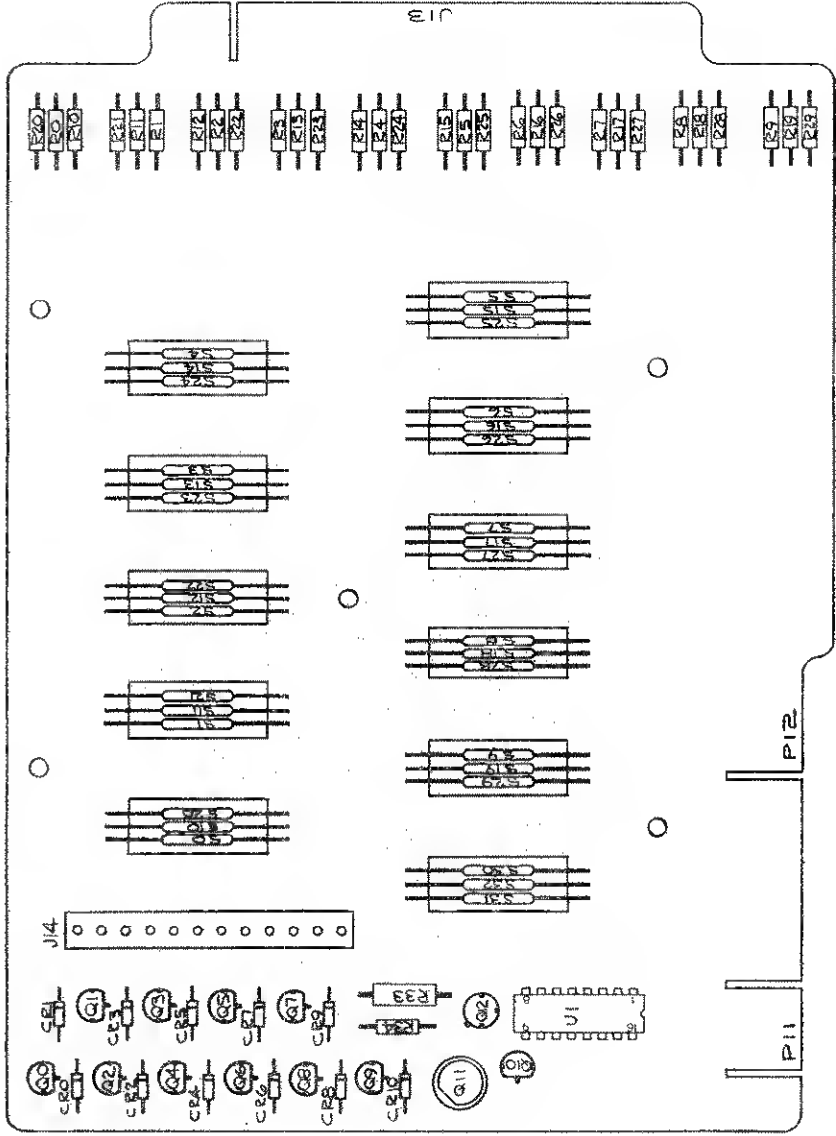
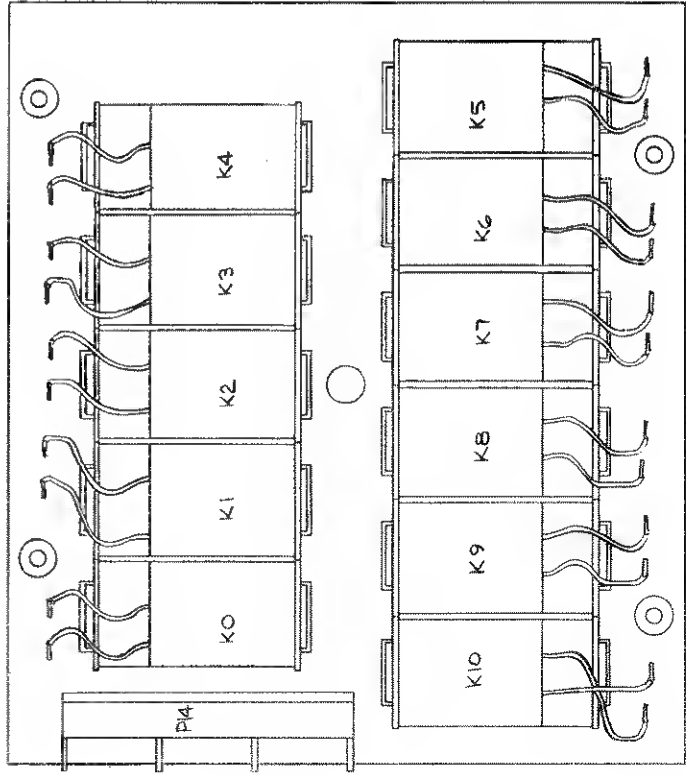
- NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
 2. ∇ (-15V) DENOTES GUARDED LOGIC COMMON (GLCOM (-15V)) WHICH IS -15V WITH RESPECT TO A/D COM.
 3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
 4. ALL VOLTAGES NOTED ARE WITH RESPECT TO A/D COM.

| REF. DES. | U1 | PIN NO. | |
|-----------|----|---------|-------|
| | | GL+5V | GLCOM |
| | | 16 | 8 |

| REFERENCE DESIGNATIONS | | Q11 | |
|------------------------|----------|-----|--|
| LAST USED | NOT USED | | |
| Q10 | U1 | | |
| Q11 | Q13 | | |
| Q12 | Q14 | | |

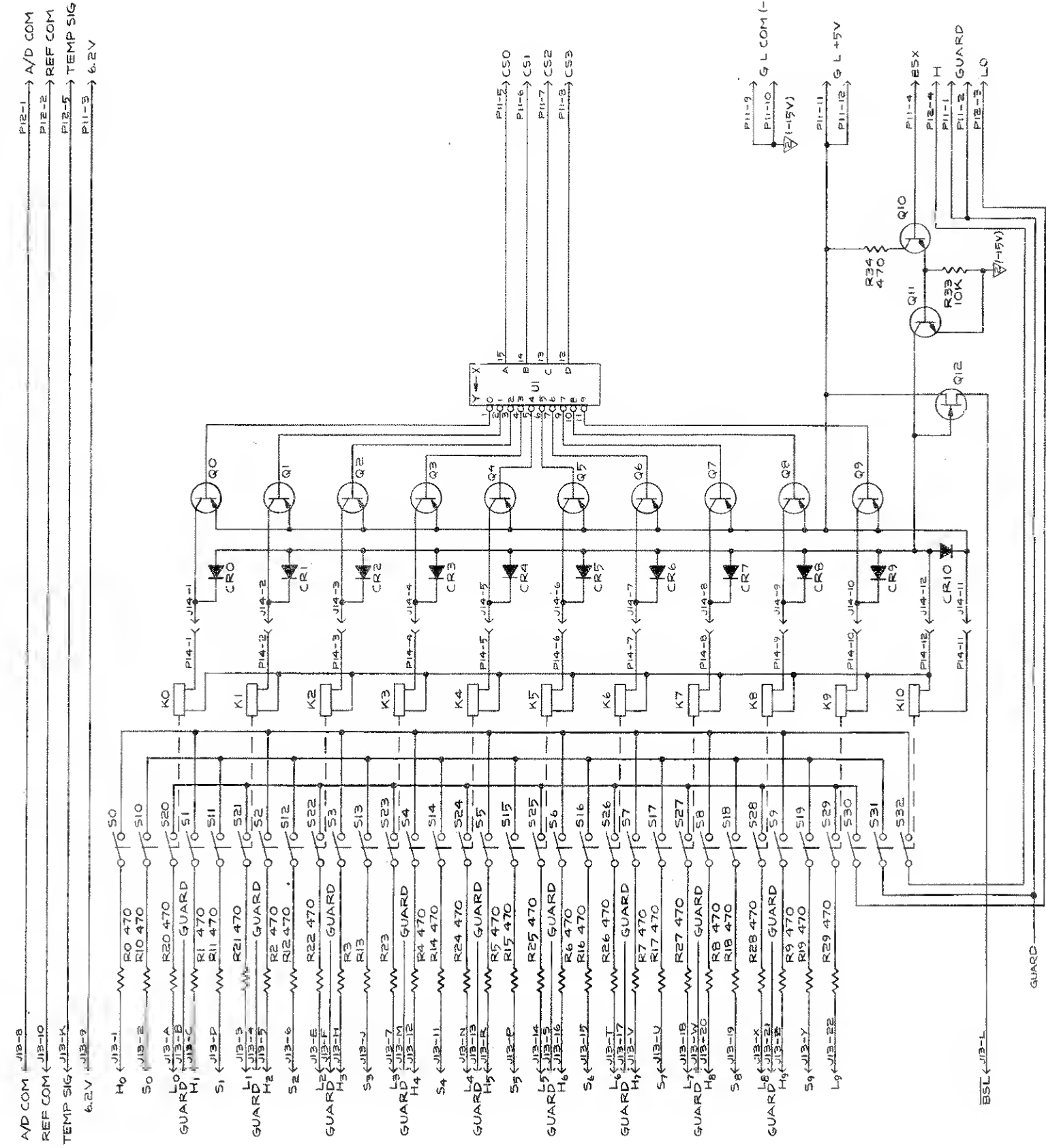
2200A-1037
General Purpose PCB Assembly

Figure 9-12. Option -400, Four-Wire Resistance Scanner Module (cont)



2200A-1629
Low Level Scanner PCB Assembly

Figure 9-12. Option -400, Four-Wire Resistance
Scanner Module (cont)



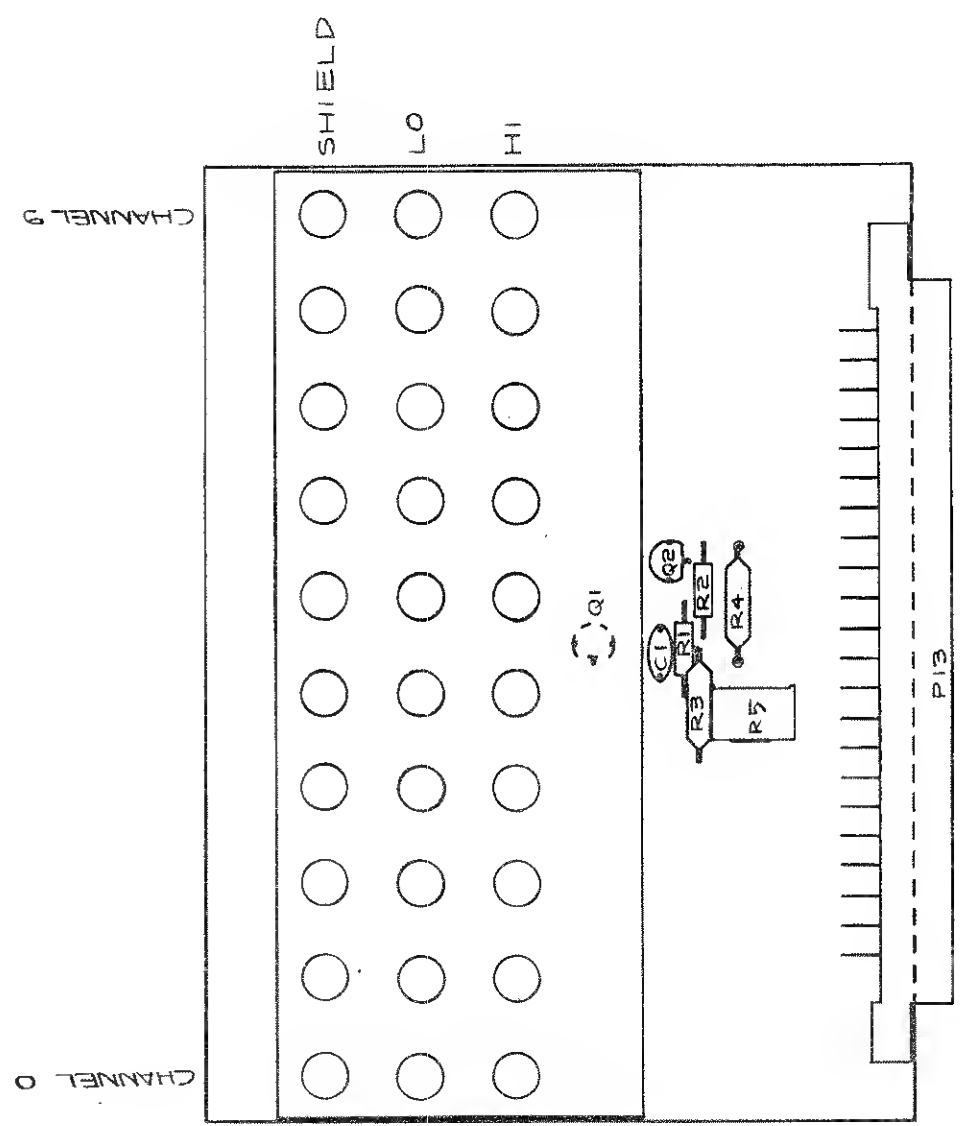
- NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
 2. ○ DENOTES CALIBRATION ADJ POINTS. ALL POINTS ARE SCREWDRIVER ADJUST.
 3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
 4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.2, AND Y32.14.
 5. V(-15V) DENOTES GUARDED LOGIC COMMON [G L COM (-15V)] WHICH IS -15V WITH RESPECT TO A/D COM.
 6. ALL VOLTAGES NOTED ARE WITH RESPECT TO A/P COM.

| IC REF DES. | PIN NO. |
|-------------|---------|
| U1 | 16 |
| | 8 |

| REFERENCE DESIGNATIONS | |
|------------------------|----------|
| LAST USED | NOT USED |
| CR10 | 532 |
| K10 | U1 |
| Q12 | |
| R34 | R30-32 |

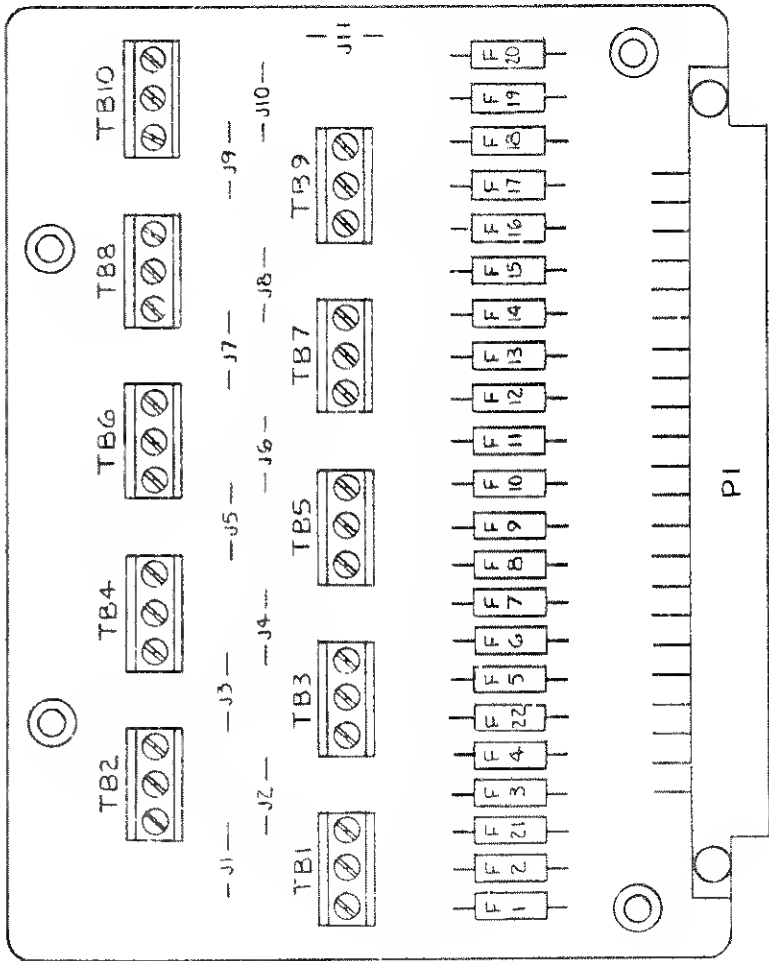
2200A-1029
Low Level Scanner PCB Assembly

Figure 9-12. Option -400, Four-Wire Resistance Scanner Module (cont)



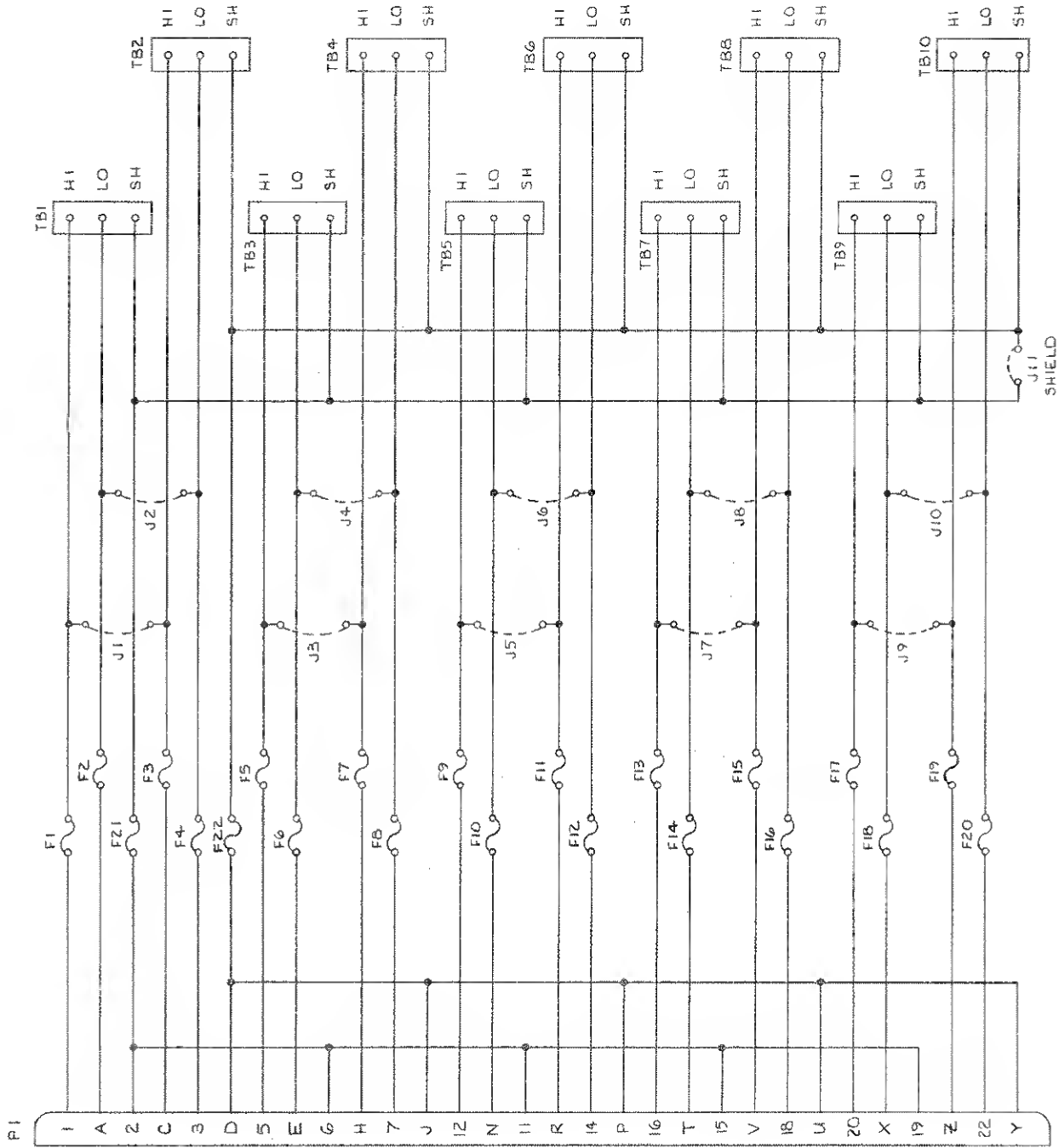
2200A-1623
Isothermal Input Connector

Figure 9-12. Option -400, Four-Wire Resistance
Scanner Module (cont)



2205A-1607
Fused Terminal Connector

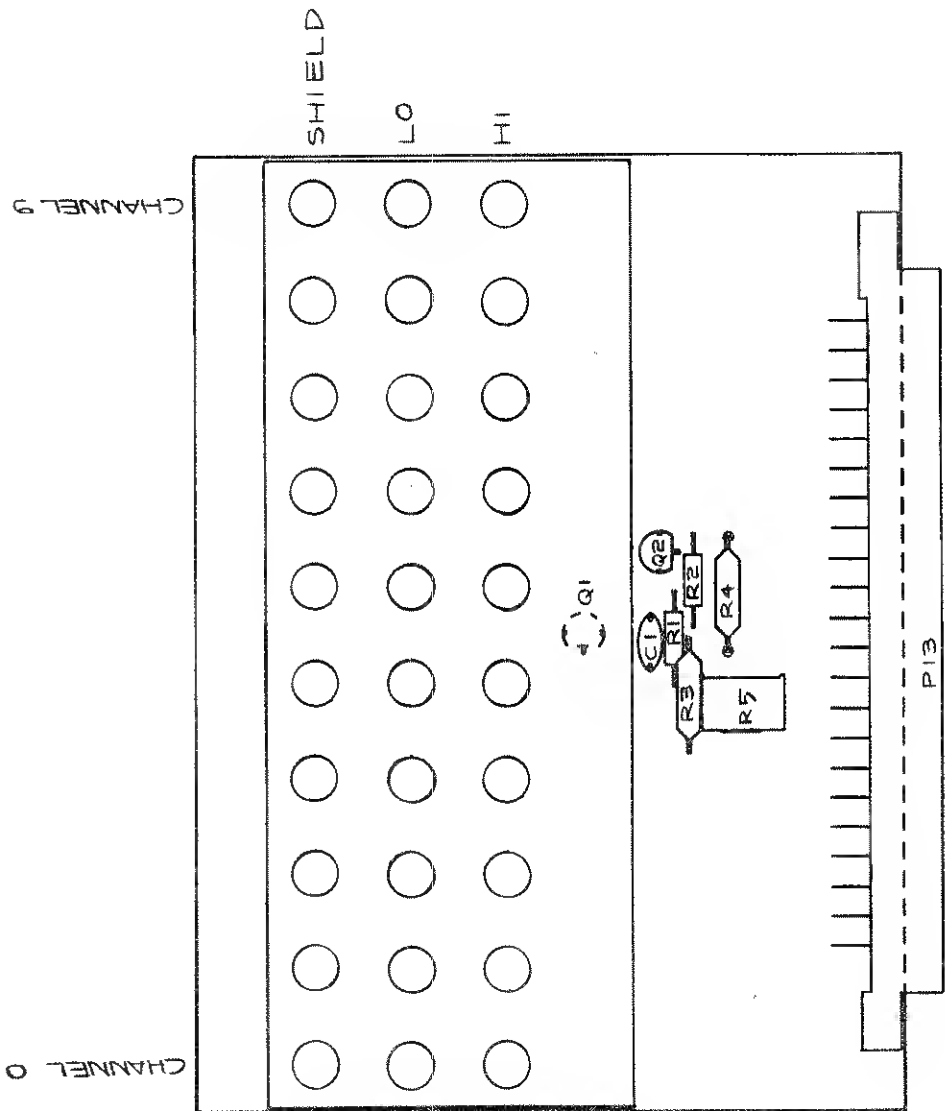
Figure 9-12. Option -400, Four-Wire Resistance
Scanner Module (cont)



- NOTES:
- 1. UNLESS OTHERWISE SPECIFIED:
ALL FUSES ARE 1/2 A, 125 V.
 - 2. DESIGNATIONS OF TERMINAL STRIPS WHEN
USED WITH GENERAL PURPOSE SCANNING
& LATCHING CARDS SHOWN IN TABLE BELOW:

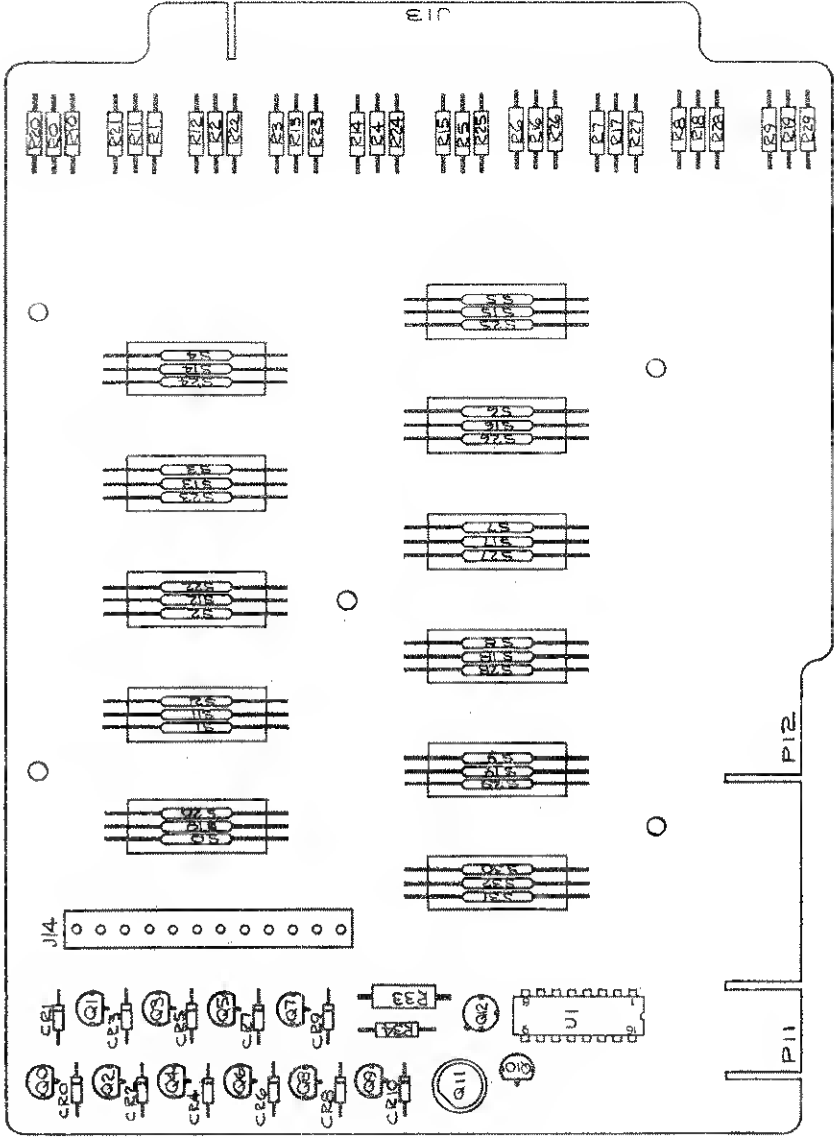
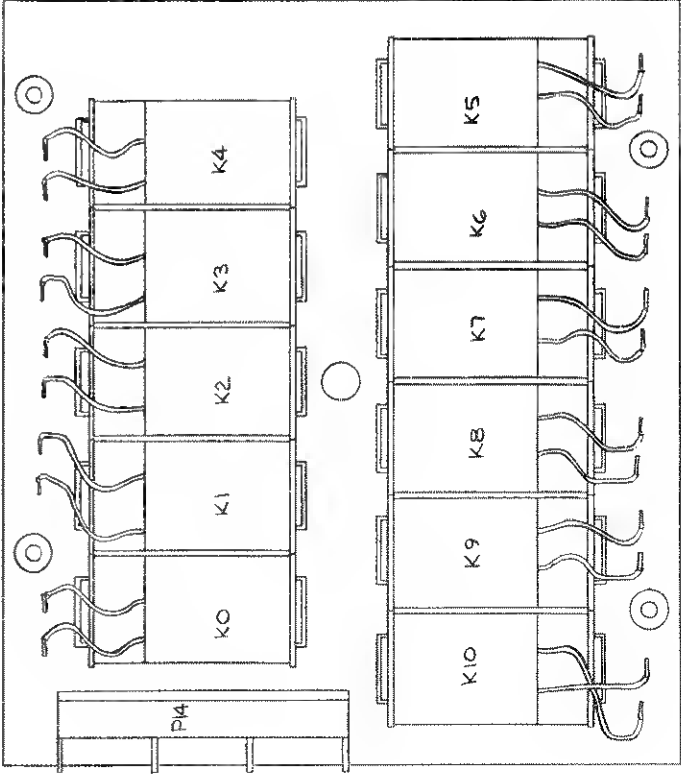
| TERMINAL STRIP | LATCHING | SCANNING |
|----------------|----------|----------|
| TB1 | CH0 | CH0 |
| TB2 | CH4 | CH1 |
| TB3 | CH1 | CH2 |
| TB4 | CH5 | CH3 |
| TB5 | CH2 | CH4 |
| TB6 | CH6 | CH5 |
| TB7 | CH3 | CH6 |
| TB8 | CH7 | CH7 |
| TB9 | BUS A | CH8 |
| TB10 | BUS B | CH9 |

Figure 9-12. Option -400, Four-Wire Resistance
Scanner Module (cont)



2200A-1623
Isothermal Input Connector

Figure 9-13. Option -600, Low Level Scanner Module



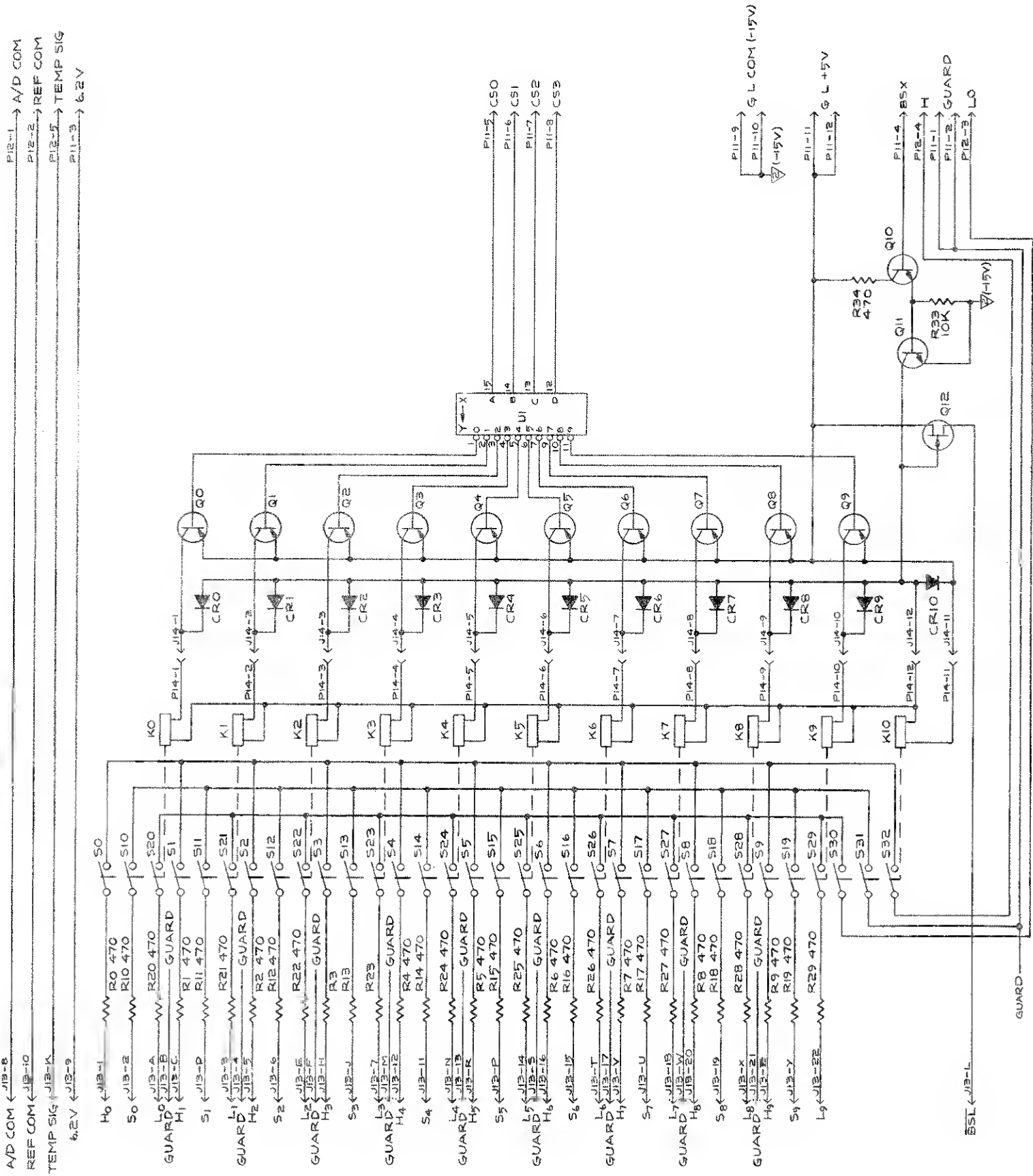
2200A-1629
Low Level Scanner PCB Assembly

Figure 9-13. Option -600, Low Level Scanner Module
(cont)

- NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
 2. DENOTES CALIBRATION ADJ. POINTS. ALL POINTS ARE SCHEMATICALLY ADJUST.
 3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
 4. (-15V) DENOTES GUARDED LOGIC COMMON (G L COM (-15V)) WHICH IS -15V WITH RESPECT TO A/D COM.
 5. ALL VOLTAGES NOTED ARE WITH RESPECT TO A/D COM.

| REFERENCE DESIGNATIONS | |
|------------------------|----------|
| LAST USED | NOT USED |
| CR10 S32 | |
| K10 U1 | |
| Q12 U1 | |
| R34 | R30-32 |

| IC REF DES | PIN NO. |
|------------|---------|
| U1 | 16 |
| | 8 |



2200A-1029
Low Level Scanner PCB Assembly

Figure 9-13. Option -600, Low Level Scanner Module (cont)

